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OCTOBER, 1954 VOLUME 52 • NUMBER 10

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COMING SOON

Tin plate production at one of the country's west coast plants is described.

Advantages of low efficiency plating baths as control factors.

An overall picture of chromate treatments as protective finishes, and their application.

The use of potassium oxalate as a complexing agent in the boric acid analysis in nickel solutions.

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METAL FINISHING

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How Much Are You Wasting?

In this issue appears an article on rinsing by *J. B. Mohler*, to be followed in a forthcoming issue by another article by *Joseph B. Kushner* on a different phase of the same subject. Both authors need no introduction to the readers of METAL FINISHING, but we would urge that these articles be made required reading for operators of all plating departments, large and small.

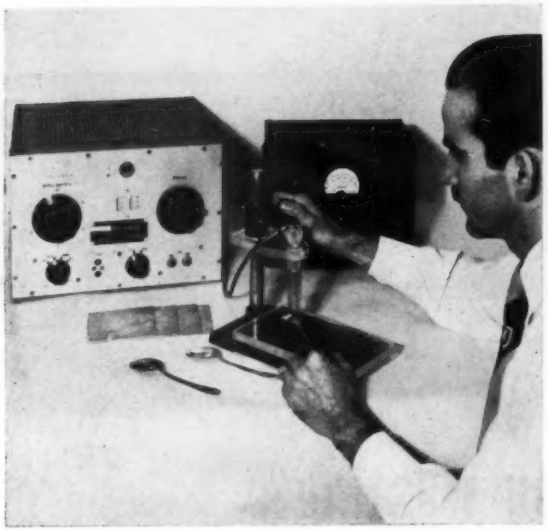
From time to time we have pointed out, on this page, the necessity for platers to bestir themselves about their use and misuse of the industry's cheapest yet most valuable chemical — water. We have warned about the deteriorating resources in many industrial areas and the increasing tendency for authorities to take notice, not only of its wasteful use but of the special demands on municipal sewage treatment and disposal systems.

Cities like New York have instituted a sewer charge based on the amount of water purchased and amounting to an increase in one-third of the water bills. A number of others have already set sewer service rates on the basis of chemical composition of the sewage, with the result that processors discharging wastes with a specified degree of pollution pay a surcharge of up to 50 per cent above the normal bill of users discharging less waste water or water with little contamination, which is less costly to treat. Minimizing these surcharges and penalties offers economies which can very rapidly amortize the equipment required for efficient rinse water use.

The above-mentioned articles demonstrate the very impressive decrease in water consumption resulting from the use of two and three stage rinses. Not only is this done without any sacrifice in rinsing effectiveness but the work even leaves the final rinse tank in a cleaner condition!

With the addition of small pumps to recycle some of the rinsing stages to other tanks, making some of the rinses do double duty and, in many instances adding a deionizer, it is amazing how much rinsing can be done with so much less water. Yet too many plants continue to use single stage rinse tanks either through ignorance or indifference. One of these days such operators will find they have either to fish or cut bait — and in a hurry.

Nathaniel Hall



New Thickness Gages for Metallic Coatings

Fig. 1. The "Dermitron" provides a particularly convenient means for measuring the thickness of plated coatings on silverware. In making a measurement, the circuit is first adjusted so that the meter (center background) reads zero when the probe is placed on a specimen of the bare basis metal. A reading is then taken with the probe placed on the test surface, and the thickness of the coating is obtained from a calibration curve.

THE National Bureau of Standards has recently developed three types of instruments for measuring the thickness of electrodeposited coatings. While all three instruments depend upon the difference in electrical conductivity between the plating and the basis metal, each makes use of different methods for sensing specimen resistance. Two of the instruments, the Dermitron and the Phase-Angle Thickness Meter, utilize electromagnetic coupling to the specimen, making use of the reflected field from eddy currents induced in the specimen. A third, a waveguide inspection tool, employs direct conductivity measurement with point electrode. All three devices permit simple nondestructive determination of plating thickness of sample thickness for homogeneous metals. When appropriately calibrated, they can be used for measurement of magnetic as well as non-magnetic materials.

The Dermitron senses the reflected flux in a single coil which is excited with high frequency current when it is in close proximity to the specimen. The probe coil is very small and is designed to be held in physical contact with the sample. Its miniature size makes it possible to measure plating thicknesses of small specimens and sharply-curved surfaces. When the instrument is calibrated for the specific use, measurements can be made on combination of metals regardless of whether either coating or basis metal is magnetic or nonmagnetic. The instrument is portable and direct reading and should provide a convenient means for routine testing of a manufacturer's output.

The Phase-Angle Thickness Meter relies on the measurement of reflected electromagnetic field with a separate pickup coil. For this it requires a somewhat more complicated electronic circuit. Originally developed for the rapid, continuous measurement of the thickness of silver plating on such large areas as stainless steel wave guides, it offers insensitivity to variation in probe-to-sample spacing. With suitable calibration, the instrument can also be used on magnetic materials, but probe-to-sample spacing must be controlled.

The Waveguide Plating Quantity Indicator was developed to permit measurement on both nonmagnetic and magnetic materials without change of calibration. The specific application was for use on waveguides having an intermediate layer of nickel of unknown thickness between the silver and stainless steel. In the instrument a d-c current is passed through the specimen, and the voltage drop across a known distance is measured. While the silver plating is on the inside of the waveguide, its effect on the d-c conductivity measurement is the same as for outside plating. Thus the probe electrodes can be arranged to make contact on the outer surface, simplifying the measurement procedure.

The demand for a non-destructive test method which could be made with a portable economical instrument led to the development of the three NBS gages, each designed for a specific application.

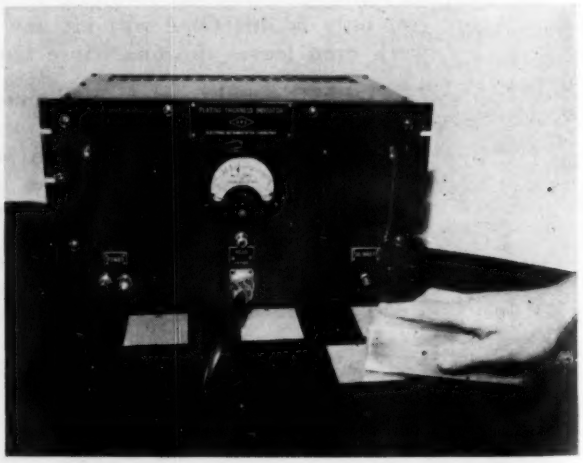


Fig. 2. Phase-angle thickness meter. This instrument features insensitivity to variations in the probe-to-sample spacing in determining the thickness of silver plating on a non-magnetic basis metal.

Fig. 3. The waveguide plating indicator conveniently measures from the outside the quantity of silver plating on the inside of an L-band waveguide. The indicator is simple to use: the operator need only place the probe on the waveguide and then read the meter.

The Dermitron

The Dermitron was developed by *Abner Brenner* and *Jean Garciá-Rivera* with the assistance of *B. Wagoner, Jr.*, and *R. L. Hill*, all of NBS, under a program of basic instrumentation sponsored at the Bureau by the Department of Defense and the Atomic Energy Commission; financial support for the project was also provided by the Bureau of Engraving and Printing, Treasury Department.

The NBS instrument makes use of the "skin effect," by which an eddy current induced a metallic surface can be limited to a thin surface layer through the use of a high-frequency current as the inducing agent. The depth of penetration of the induced current is inversely proportional to the square root of the frequency of the inducing current and directly proportional to the resistivity of the metal. Thus, for a given frequency, the magnitude of the eddy current induced in a surface layer will depend upon the conductivity of the layer, other factors being constant. If the coating and the basis metal have different conductivities, the effective conductivity of the composite surface layer, and hence the magnitude of the induced eddy current, will depend to a large extent upon the thickness of the coating.

In this instrument the magnitude of the induced eddy current is measured indirectly through the effect of its magnetic field, which opposes that of the inducing current. The opposition of the two magnetic fields lowers the impedance of the high-frequency coil, thus permitting more current to pass through it. The changes in the current flowing through the coil are shown on a meter in series with it.

In practice no calculations are required as calibration curves are used which are made with specimens of known thicknesses. Each pair of metals requires an individual calibration curve having two limits. One limit is the reading of the meter when the probe coil is brought near the bare basis metal; the other is the reading with the probe adjacent to a layer of the coating that is thick enough to yield the maximum effect on the current. Power is supplied by a commercial oscillator with a 6-watt output, and the amount of current through the circuit is controlled by means of a voltage divider placed across the oscillator.

Initially the meter is made to read zero when the probe is placed on a reference surface of the bare basis metal. The test probe is then placed on the metallic surface to be tested, and the resulting change of impedance is indicated by the meter reading, which depends upon the conductivity of the metallic surface layer.

The range of thickness which can be measured depends upon the frequency used. A given frequency may be used only for thicknesses through which a significant amount of current penetrates. High frequencies are most suitable for accurate measurement of thin coatings because the penetration of the current is shallower. At a frequency of 2 megacycles most coatings up to 1.5 mils in thickness can be measured accurately. A frequency of 100 kilocycles permits coatings up to 6 mils to be measured, but measurements of thin deposits are not so accurate at this frequency as at 2 mc.

The diameter of the test probe must be made small to diminish the effect of the geometry of the object on the measurement. This means that very low frequencies which require large coils, cannot be used to advantage. A typical coil, used at 2.5 mc, is 0.030 inch in length and 0.10 inch in diameter. The coils are wound on a bobbin and are cast in a resin for sturdiness and stability.

Studies of the range and sensitivity of the gage at various frequencies and on different metal combinations are continuing at NBS. Another problem now under investigation is the possibility of making measurements of coating thickness without the use of prepared standards with which to calibrate the instrument. This might be done by using a range of frequencies rather than a single frequency, but practical difficulties must first be overcome.

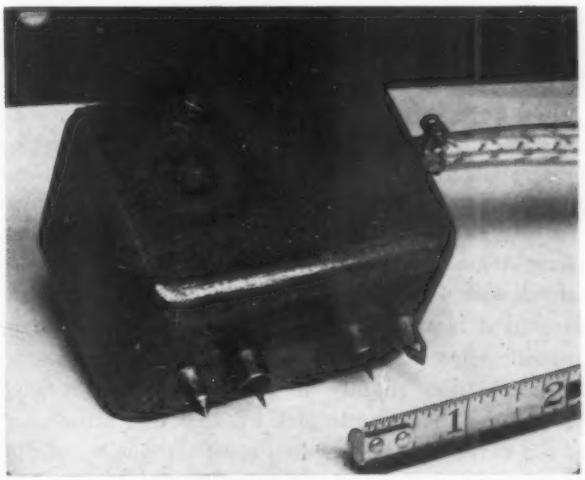


Fig. 4. Hand-held probe assembly for waveguide plating indicator. The two outer electrodes provide a source and sink of current, and the two inner probe tips measure the voltage difference across two points in an intermediate area.

The Phase — Angle Thickness Gage

The Phase-Angle Thickness Gage was developed by *W. A. Yates* and *J. L. Queen* of the National Bureau of Standards for the Navy Bureau of Ships. The probe of this instrument consists of a mutual inductance transducer which is held in proximity to the sample but not necessarily touching it. A buckout transformer, shielded from the influence of the sample, is also located on the probe head. These two elements are electrically connected and excited with r-f current in opposition, producing output voltages whose phase difference is responsive to the conductance of the sample. A phase meter, specifically designed for use with the probe, is calibrated for the desired frequency ranges. For direct reading of thickness, the phasemeter output is indicated on a meter calibrated in mils of silver which has been applied to a basis of 0.037 inch of stainless steel. In use, the instrument is is adjusted first for null phase difference when the probe is held away from the influence of the sample. Thereafter thickness readings are obtained by bringing the probe in proximity to the specimen—usually within one-eighth inch. The readings obtained are not affected by probe-to-sample spacing when it is less than this amount.

The choice of operating conditions for a plating thickness meter is strongly influenced by the circumstances under which it is to be used, since the deposit and basis metal both contribute to changes in the phase angle. For a thin deposit of low resistivity on a basis metal of high resistivity, the problem is one of measuring the plating thickness alone. As the resistivities approach the same value (i.e., thinner basis and thicker plating), it becomes difficult to differentiate between the plating and the basis metal. However, this condition is not reached in the application for which the instrument is intended, since the resistivities of silver and stainless steel are greatly different. If the thickness of the basis material varies, the frequency of the exciter may be increased until the transducer field does not entirely penetrate the thinnest portion of the base. If the basis thickness is constant, however, a higher sensitivity may be obtained by lowering the operating frequency to a point where the calculated skin depth of the material is greater than its thickness.

In a series of tests at the National Bureau of Standards, the instrument was used to measure the thickness of silver plated on one mil of nickel which was, in turn, plated on 37 mils of stainless steel. The results indicate that, as the silver thickness increases, the phase angle approaches a value which might be obtained with silver alone. Experimental findings also show that nickel, with its high permeability, has an opposite effect to that of the silver plating in that it tends to reduce slightly the phase angle. The magnitude of the effect due to nickel is therefore a function of the silver thickness as well as of the quality of the nickel itself. Nickel quality is especially important if the nickel is a low grade and improperly applied, since its magnetic properties vary widely with impurity content.

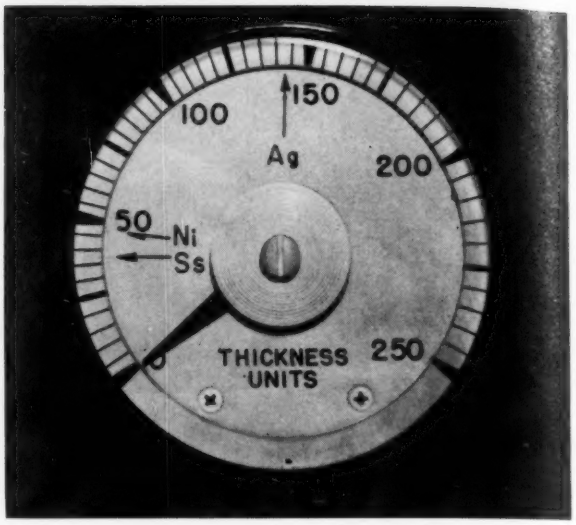


Fig. 5. Thickness indicating meter on waveguide plating indicator. For use as an inspection tool to determine if a finished waveguide is acceptable, the "Ag" mark on the meter scale may be used as the acceptance limit where readings below this mark indicate underplating.

The Waveguide Plating Quantity Indicator

The Waveguide Plating Quantity Indicator was developed by *M. Davidson* and *N. Rahal* of the National Bureau of Standards under the sponsorship of the Navy Bureau of Ships. While designed specifically for measuring from the outside the quantity of silver plating on the inside of an L-band waveguide, the instrument is useful for a wide variety of plating or thickness measurements. Its calibration is unaffected by the magnetic properties of the material under test.

The instrument actually measures the conductance of the silver deposited on the steel wall. Variations in the density and in the thickness of the silver cause a much greater change in the total conductance than similar variations in the steel. Since the probe measures over an area of only several square inches at a time, it is possible to compare any local portion of the waveguide wall with any other portion.

Although the conductance measuring technique has been used before to make thickness measurements of homogeneous plates, it is used in the NBS instrument to determine the thickness of one material of high conductivity plated on another material of low conductivity. The Bureau's procedure overcomes the limitations of previous methods for stainless steel waveguides by relying on a direct-current measurement of the conductance of the waveguide walls and the plated coating. The local conductance is measured by passing a known amount of direct current through a portion of the waveguide wall, using a pair of electrodes or probes. By measuring the potential between two other points in the neighborhood of the current probes, the conductance can be determined, provided (1) that the current flow is laminar throughout the material and (2) that the linear dimensions of the material are several times greater than the probe spacing. Laminar, or two-dimensional, flow is achieved by making the current probe spacing much greater than the thickness of the waveguide wall.

The Bureau's plating indicator consists of two units. One is the hand-held probe which is applied to the waveguide. The other is a chassis which contains the detecting and measuring circuitry, the power supplies, and a calibrated indicating meter. The probe housing contains two pairs of electrodes or probes to supply current and to measure potential. The current probes are pointed brass rods spaced about two inches apart and are slightly blunted to keep the contact resistance low since they may pass up to five amperes. The potential probes are hard steel needles; they are spring-loaded and project slightly beyond the current probes to ensure good contact.

In use, the probe points are aligned with the longitudinal axis of the waveguide. Measurements can then be made even on the corner bends with no effect on the accuracy of the instrument. Thickness measurements can also be made up to one inch from the end of the waveguide before errors due to edge effect become important.

The circuit is designed so that a constant voltage is maintained across the potential probes by varying the current through the current probes. The current required to maintain the constant potential is directly proportional to the conductance of the material and hence will vary directly with changes in the quantity of plating. By using the simple servo techniques of self-balancing, the indicator is made to read directly and is automatized to such an extent that the indicating meter and a power switch are the only components on the front panel; there are no operating adjustments.

When the probe is lifted from the waveguide, a switch in the probe housing shunts the current flow and at the same time disconnects the servo motor. Thus the ammeter reading is maintained whenever the probe is removed, and a rapid succession of readings can be made since the meter needle does not need to start from the zero mark for each reading.

In practice, an L-band waveguide usually has a layer of nickel plate between the silver and the steel to facilitate adhesion of the silver and to provide additional protection against corrosion. Studies of the relative conductances and thicknesses of the respective layers show that a direct measurement of the d-c conductance between a pair of points will give sufficiently sensitive indications, within reasonable limits of error, of the amount of silver deposited on the nickel-plated stainless steel wall. The instrument interprets this conductance measurement in terms of "thickness units." One thickness unit is equivalent to the conductance of 0.001-inch thick stainless steel. Since nickel has a conductivity 10 times that of stainless steel, 0.001 inch of this material is equivalent to 10 thickness units. One-thousandth inch of silver, with a conductivity 48 times that of stainless steel, measures 48 thickness units. The specified composite of the three materials in the waveguide—0.037 inch of stainless steel, 0.001 inch of nickel, and 0.002 inch of silver—has a total relative conductance of 143 thickness units. If the amount of deposited nickel were to vary by 50 per cent, the error in the indication of the amount of silver present would be only 5 per cent. A tolerance of 0.005 inch in the thickness of the steel wall would have the same effect.

The conductivity of the plated silver may vary downward to one-half the nominal handbook value, depending on the variables which enter into the electrodeposition process. However, if the metal is reasonably pure, the total error in this method of measuring equivalent thickness will not exceed five per cent. A limited series of controlled tests on plated samples at the Bureau showed a maximum error in thickness measurements of 1.5 per cent. The instrument can also be used for determining plating quantity on other frequency band waveguides, provided that the construction techniques and materials are similar to those of L-band waveguides.

NOTE: For further technical details on these instruments, see Brenner and Garcia-Rivera, Plating, **40**, 1238 (1953); Yates and Queen, AIEE Transactions, (Communications and Electronics) No. 12, May 1954, pp. 138-142.

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Counterflow Rinse Tank Design

By J. B. Mohler, *Chemist, New Castle, Pa.*

THE business of changing an art into a science is an endless task. The earliest electroplating methods were scientific as compared to soldering, fusion and rolling methods of making Sheffield plate. And yet the method of making Sheffield plate was the scientific answer of the day to the problem of producing silver-clad copper as a low price substitute for solid silver alloys used for decorative purposes. Overcoming the art of our fathers is the science of today.

In these days of quality control, mathematical probabilities, mass production, and ever expanding technology, many research dollars are being spent to probe deeper into the economics of details.

Water, which often comes from the skies in unwanted abundance in torrents and floods, is becoming an increasing problem. The water in our town is, in part, merely the industrial waste and treated sewage of the town above us on the river. During the dry days of the year the supply runs low so that economic use of water becomes a necessity. However water does cost money and, in addition to doing a service for the community, the preservation of water can pay for itself and make a profit in the bargain.

Rinsing Equations

As an approach to the problems of rinsing Pinkerton[1] has examined the equation of Kushner and others and has presented certain usable equations. The most important of these equations is one that expresses the "limiting" average concentration attained in a rinse tank at equilibrium." And an important conclusion was drawn from this equation that "The size of the rinse tank does not influence the equilibrium concentration."

This equation is of the form:

$$(1) \qquad C = \frac{DC_o}{QM + D}$$

Where C_o = concentration of salt in drag-in
D = volume of solution dragged in
Q = flow rate of rinse water
M = time interval between dipping operations
C = highest concentration reached in the rinse tank under equilibrium conditions.

This equation can be used to make a fairly accurate estimate of the concentration of soluble chemicals that will be obtained for continuous carry-through of work in a running rinse tank. The question assumes that the amount of drag-in is exactly the same on each rack and that the racks enter the rinse tank at exact intervals. In automatic plating this condition is closely approached and in manual plating it is approximated.

A fundamental limiting ratio exists that is useful to approximate C the equilibrium concentration in the rinse. This can be derived from Equation (1) by using as a basis the amount of water flowing per rack.

The amount of water flowing per rack may be designated as:

$$(2) \qquad G = QM + D$$

In this equation D may be ignored as a minor correction.

By dropping D in the denominator and avoiding the use of a term containing time, Equation (1) may then become:

$$(3) \qquad C = \frac{D}{G} C_o$$

In equation (3) $\frac{D}{G}$ may be referred to as the dilution ratio R, in which case we have the simple equation:

$$(4) \qquad C = RC_o$$

where R is the ratio of the volume of rinse water to the volume of solution dragged in for one rack interval. R may be based on one rack, on a number of racks or on a time basis.

Equation (4) can also be deduced by simple reasoning. If solution of a given concentration was added steadily to a tank and if fresh water was also added steadily the equation would exactly describe the equilibrium concentration for perfect mixing. A rinse tank will approach this condition closely enough for practical purposes.

Calculation of Flow in a Rinse

Let us assume a set of conditions that will approximate what can happen in a practical case. Assume that the rack area is one square foot per one gallon of solution flowing in the rinse. Also that one fluid ounce of solution is dragged in for one square foot of area and that the concentration of the plating solution is 100 ounces per cubic foot. Then R is determined from one fluid ounce dragged in for one gallon of solution flowing. Since a gallon contains 128 fluid ounces the ratio is 1 to 128 or:

$$R = \frac{1}{128} = .0078$$

$$C = .0078 \times 100$$
$$= .78 \text{ ounces per cubic foot}$$

This figure has considerable meaning. It shows that in going from the tank containing the solution to the rinse that the concentration drops from 100 to 0.78. The concentrations expressed in ounces per cubic foot can be compared to other meaningful figures of concentration. One ounce per cubic foot is equal to one gram per liter. Therefore the original solution is approximately a 10% solution and the rinse is approximately 0.1% solution. Also it is interesting to recall that 0.1% solution is equal to one gram per liter and also equal to 1,000 p.p.m. Below the range of 1,000 p.p.m. a comparison can be made with the salts that are already present in the water which may run between 50 to 200 p.p.m. in many localities. Certainly the concentration of salts in the rinse is a limiting factor and calculations from Equation (4) give some idea of the amount of flow required in a rinse to approach this range.

The conditions assumed for our problem are in a practical range for many plating applications. For a total rack plus work area of one square foot per minute the flow would be 60 gallons per hour. For ten square feet per minute the flow would be 600 gallons per hour.

Rinsing to approximately one ounce per cubic foot may not be adequate in many cases. This concentration may cause water stains on the work or it may lead to process troubles on the work or possibly chemical troubles in succeeding tanks. This can only be determined by observation of troubles at the plating line, but it is definitely helpful to know what is going on at the rinse tank.

If there is trouble due to poor rinsing the tendency is to use more water. This is easily done, by the twist of a valve. And, it is a natural thing to do. Water is so common, so abundant, and we see so much of it flowing down the drain, that more water seems like the simple answer to the busy plant foreman. Also, as a temporary expedient, it may be the logical immediate answer, but a look at the cost of water is a very convincing inducement to pay the cost of more economical rinse tank design.

The Double Rinse

The basic, economic rinsing problem is to do an adequate rinsing job at a minimum of cost. If two rinse tanks are used, the same amount of rinsing can be done with less water. This means the cost of two tanks in place of one and possibly the use of stainless steel in place of ordinary low carbon steel.

At high flow rates through a rinse tank the rust that forms on low carbon steel may be carried away fast enough to avoid trouble from this source, but at low flow rates stainless steel or a lined tank is desirable to avoid problems with rust.

If two rinse tanks are used in place of one in a plating line it may mean the labor of an extra dipping operation following each step. In many cases this is not so. In an automatic cycle it does not increase labor although it does add to equipment costs. In many hand operations where there is a problem of trapping solution in the rack it is often desirable to completely submerge the rack, raise it above the rinse solution level, allow it to drain and then repeat these steps. If such a procedure is used then two rinse tanks take no more time than one. Also, with two rinse tanks there is the advantage that it is necessary to raise the rack above the solution level after the first dip in order to dip in the second rinse.

The Counterflow Rinse

If the decision is made that it is more economic to use two rinse tanks than one, then it will be worth while to design the rinse tank on the principle of counterflow in order to use the same water more than once.

Assuming again, one gallon of water flowing per fluid ounce of solution dragged-in: Figure No. 1 is a diagrammatic example of what may be expected from a double counterflow rinse tank. The work passes through tank No. 1 and then tank No 2. The water enters tank No. 2 and passes from there to tank No. 1. The prin-

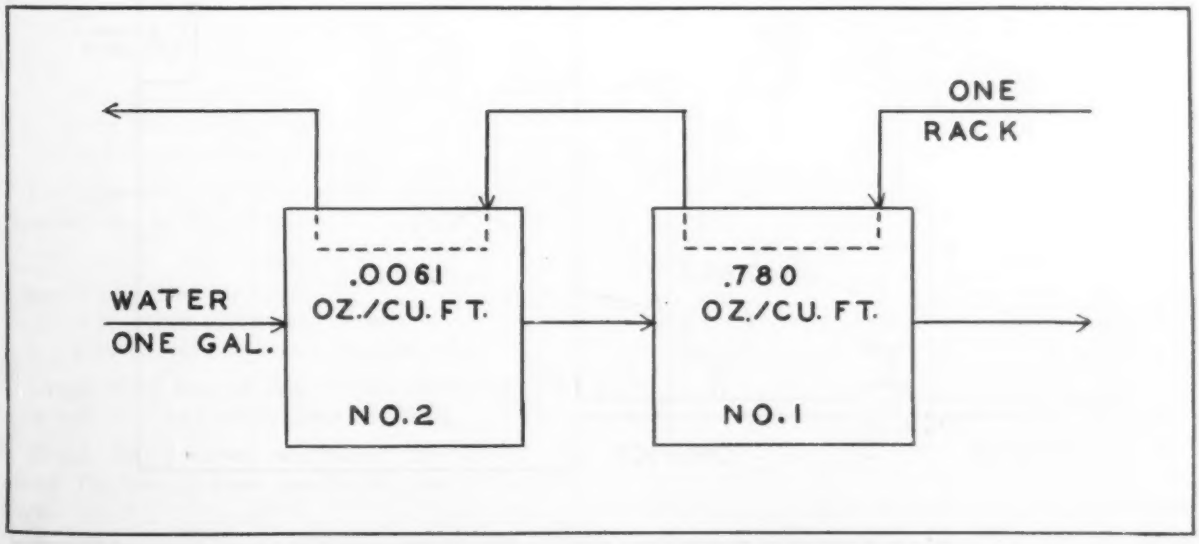


Figure 1. Diagrammatic example of a double counterflow rinse tank.

ciple is that the rack is first rinsed in the most contaminated solution and finally rinsed in the cleanest solution. Equation No. (4) still holds for this case, since essentially all of the drag-in will build up in tank No. 1. The drag-in to tank No. 2 will build up according to R from the drag-out of tank No. 1. Thus it is seen that the equilibrium concentration in the final tank in a counterflow system can be estimated from the equation.

$$C = R^n C_o \qquad (5)$$

where n = the number of tanks in the counterflow system.

Equation (5) will also be a good approximation for a series of separately fed tanks providing the flow is the same to each tank. It is readily seen then that a double counterflow rinse will do the same rinsing job as two separate rinse tanks with one half the water. But either system will do the same job as a single rinse with only a fraction of the water.

Table No. 1 shows the results of calculations for one ounce of solution with variations in the flow; and for a single rinse tank, a double rinse tank and a double counterflow rinse tank. It is seen that, to obtain the same equilibrium concentration with a single rinse, as with a double counterflow rinse with a flow of one-half gallon, requires 64 times as much water. Also it is seen that, for the same total amount of water used, a double counterflow rinse will reduce the equilibrium concentration to ¼ of what is obtained with a double rinse. This is merely because the flow through the tank is double the rate. With a double rinse the equilibrium concentration varies inversely as the square of the flow, whereas in a single rinse it only varies inversely as the flow.

Table No. 1

	Ounces per Cubic Foot Concentration in Final Tank		
Total Flow Gallons	*Single Rinse*	*Double Rinse*	*Double Counterflow Rinse*
0.5	1.56	0.097	0.024
1.0	0.78	0.024	0.0061
5.0	0.156	0.00097	—
10.0	0.078	—	—
32.0	0.024	—	—

Use of Flow Meter

It is one problem to determine the allowable equilibrium concentration in a rinse tank and it is another problem to control the flow to avoid exceeding this concentration. If a sufficient excess of rinse water is allowed, the flow may be estimated by observing the overflow by use of a weir. However construction and calibration of an accurate flow meter is a relatively simple problem. Figure No. 2 shows a diagram for such a flow meter. It consists of a pressure gage inserted between an orifice and the valve for the rinse tank. Since the flow is against a constant head, the calibration will be accurate. The flow meter can be calibrated by catching the water from the overflow for a definite time interval. Or, in the case of a counterflow tank, it can be calibrated by observing the time for the No. 1 tank to fill. The only real problem is to estimate the size of the orifice required in order to obtain the desired flow with a convenient reading on the pressure gage.

After a flow meter is put on a rinse tank it is very convenient to be able to readily observe that the flow is correct. And it also removes the problem from the plater's mind as to whether he should use a little more or a little less water.

A standard orifice can be purchased so that one calibration will hold for all tanks of the same design. Or, an orifice can be easily made by inserting a drilled

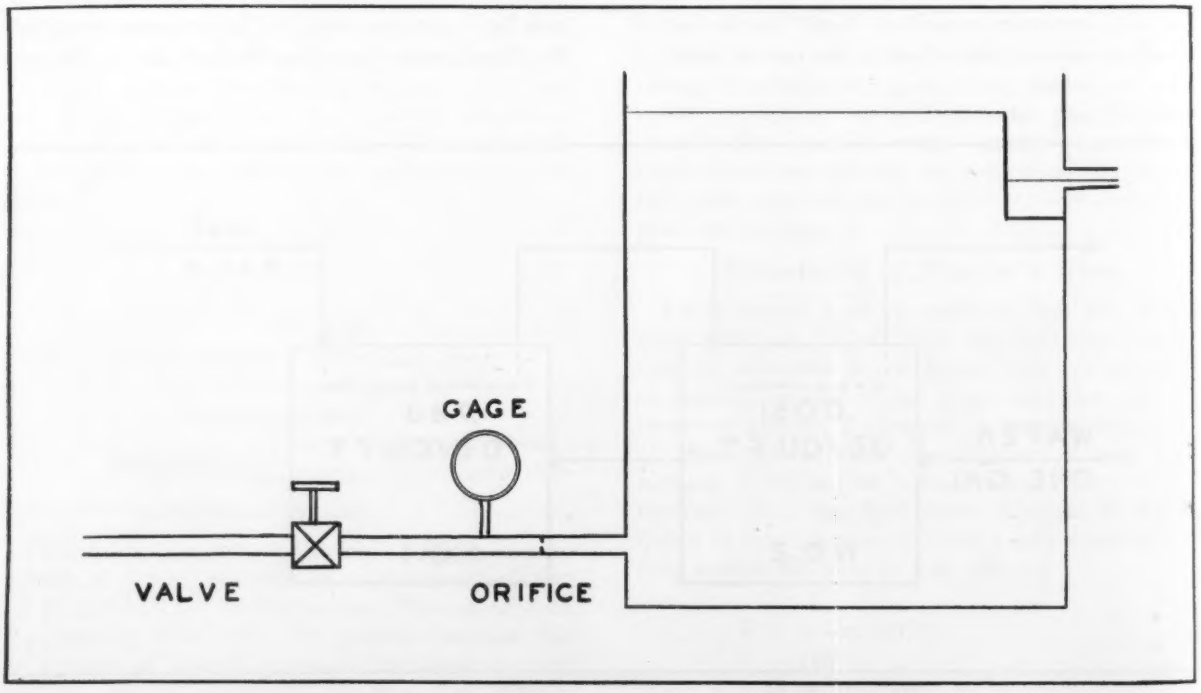
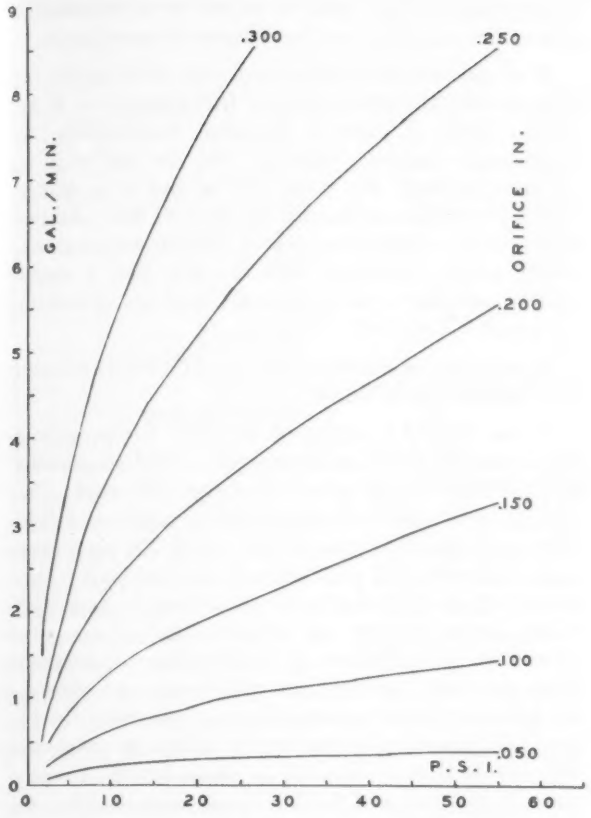


Figure 2. Construction of a flow meter for a rinse tank.



Graph 1. Approximate flow for various orifice sizes.

disk in a pipe union, or by brazing a disk inside of a short pipe nipple. The orifice disk should be made of some rust resistant metal such as stainless steel or brass.

The size of orifice required can be estimated from an equation for fluid flow through an orifice:

(6) $$Q = KCFd^2h^{1/2}$$

where Q = gallons per hours
K = 340 gal./hr.
C = orifice coefficient (about 0.6)

$$F = \sqrt{\frac{1}{1 - (d/D)^4}}$$

D = diameter of pipe
d = diameter of orifice
h = pressure head in inches

For approximating purposes for one inch pipe this equation can be simpilfied to:

(7) $$Q = 1100\, d^2P^{1/2}$$

where Q = gallons per hour
d = orifice diameter in inches
P = pressure in pounds per square foot

Graph No. 1 was calculated from Equation (6) for one inch pipe and orifice sizes as shown.

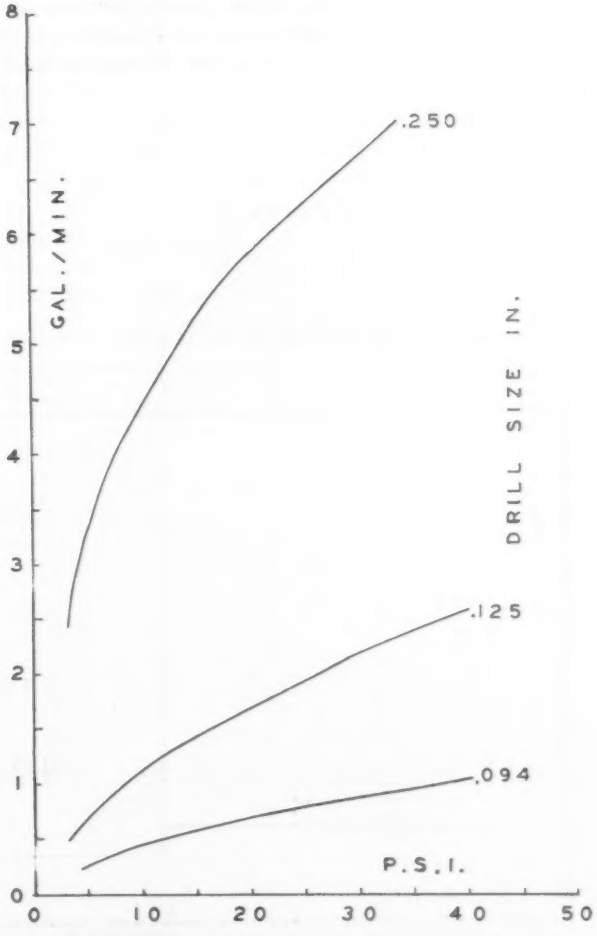
Graph No. 2 shows calibrations for various size holes. The hole sizes are actually the sizes of the drills used.

It will be seen that the shapes of the calibration curves are the same as the calculated curves. It will also be seen that Graph No. 1 only estimates Graph No. 2. However it is time saving to have a reasonable estimate of the hole size required before making a flow meter.

From equations that are available, calculations can be made to estimate the time for a rinse tank to reach equilibrium. These calculations will show that, in a practical case, equilibrium will be reached in a fraction of the working day so that during most of the operating time the rinse will be near the equilibrium condition. Also it is well to consider that the concentration in the rinse is continually changing and will readily deviate from the average conditions for any change in the drag-in or the time cycle. Also, a change in flow will cause an immediate change in concentration. In fact, in some cases it is worth while to put a pressure regulator on the water line to assure a constant flow.

Measurement of Concentration in the Rinse

If the flow through a rinse tank is controlled to a known rate then it becomes possible to make an accurate measurement of the concentration. It has previously[2] been shown that rapid and accurate measurements of the concentration can be made with a relatively inexpensive conductivity meter. By the means of such measurements a continuous record of the rinse behavior can be obtained. If such results are plotted it will be seen how the rinse readily responds



Graph 2. Calibrated flow for orifices of various drill sizes.

to drag-in and flow. It will also be seen what deviation may be expected from the calculated equilibrium concentration, how long it takes to obtain equilibrium, and what actual maximum concentration will be obtained.

After actual measurements of rinse concentration are made, it then becomes possible to select a desired maximum concentration in the rinse. This concentration can then be used as a basis for experimentation to determine a trouble free concentration at this stage in a plating cycle and thus the most economic flow.

Design of a Counterflow Rinse Tank

Figure No. 3 shows the design for a double counterflow rinse tank. The water enters at the bottom of the left tank and overflows at the surface level of the opposite side, thus sweeping the cross-section. From here it flows between the walls of the two tanks to the bottom of the next tank, then to the next overflow at a lower level than in the previous tank. The drop in level from one tank to the next and the double wall is primarily to prevent back-up of water when racks are introduced into tank No. 1. Direct contamination by back-up of the more concentrated solution, from tank No. 1 to tank No. 2, would cause some loss of effectiveness of the counterflow principle.

The Use of Triple Counterflow Rinse

There are a number of cases where a triple counterflow rinse has been used to advantage.

Returning to Table No. 1; if it is desired to calculate the flow required in a triple counterflow rinse to obtain the same final concentration as a double counterflow rinse at a flow of ½ gallon, the assumption would be:

$$C_o = 100$$
$$C = .024$$
$$D = 1$$
$$G = \left(\frac{1 \times 100}{.024}\right)^{\frac{1}{3}} = 16.1$$

It is seen that the flow would be one pint and that every time another tank is added to a counterflow system the total flow may be reduced to one-quarter.

With multiple counterflow tanks the flow can be low enough that the rinse can be fed directly to a hot plating bath, if there is sufficient evaporation, for continuous drag-out recovery. Or, in the case of cyanide disposal, the rinse can be fed to a storage tank for periodic treatment. At the low flow obtained with a triple counterflow rinse a 24-hour accumulation would not be excessive. With this low flow it should also be possible to use continuous methods of treating the rinse.

Several real examples of the use of a triple counterflow rinse are given below.

It was desired to design a hot rinse for processing 300 square feet per hour or work plated in an alkaline tin bath. In the previous design the work, after plating, was given a cold rinse to remove soluble salts and then hot rinsed for rapid drying. There were a number of problems. Unless excessive rinse water was used the hot rinse could not be kept sufficiently clean. If water was added to the hot rinse too often there was difficulty in maintaining temperature. Also, the work leaving the cold rinse and entering the hot rinse extracted considerable heat from the hot rinse. Of course, with the use of sufficient water and sufficient heat the job could be done, but the requirements for water and heat became excessive for the amount of work processed. As a solution to this problem a continuous counterflow hot rinse was designed of stainless steel. A flow meter and a water pressure regulator were used. The heat source was 15 Kw of electric immersion heaters and the flow was set at 50 gallons per hour. The heat was controlled thermostatically at 180°F. and part of the heat from the overflow was recovered with a heat exchanger to warm the inlet water to the rinse.

With this design the work was not cooled greatly after tin plating so that most of the heat picked up in the tin plating step was retained. Referring to the diagram of Figure No. 4 the water entered tank No. 3 and the work first entered tank No. 1. In tank No. 1

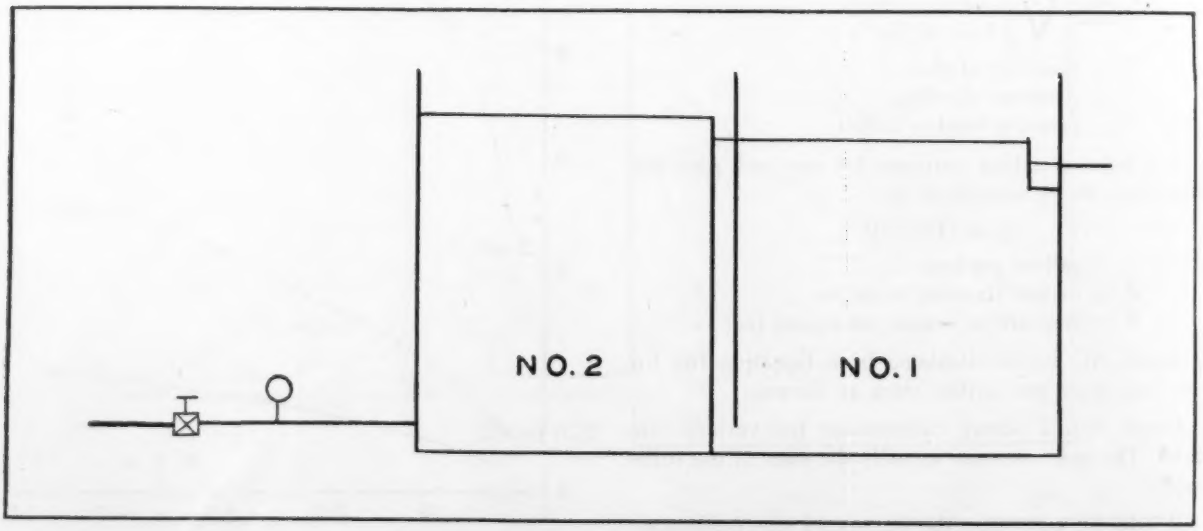


Figure 3. Design of a double counterflow rinse tank.

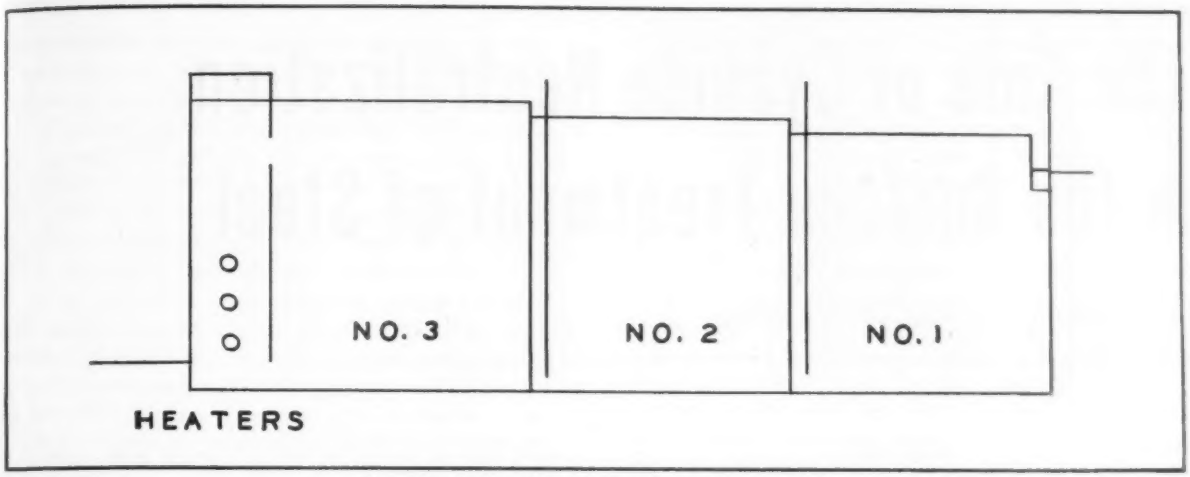


Figure 4. Design of a triple counterflow hot rinse tank.

most of the salts were washed away and the rinse was warm since the overflow originally came from the hot tank. This prevented loss of heat and obtained some value from heat lost by overflow from tank No. 3. As the work entered tank No. 2 a second stage of rinsing took place and some heat was gained. The final step at tank No. 3 resulted in a clean product with a very little time required for heating due to the preheating effects of the previous overflow tanks.

The installation was practically trouble free except that it was necessary to keep the No. 1 tank free of accumulations due to decomposition of the alkaline tin drag-in to form insoluble tin compounds.

Observation of this hot tank in operation would readily show what it was doing. The No. 1 tank contained accumulated tin compounds and was milky in color. The No. 2 tank contained only a small amount of compounds and was slightly milky. The No. 3 tank contained very slight accumulations, was sufficiently clear to readily see the bottom of the tank and the pH was sufficiently low that the water did not have a slippery feel.

In another problem it was decided to remove oil from freshly dipped work by dipping in cold solvent, at the rate of 10 square feet per hour. The operation was a blacklighting operation which consisted of the following steps:

1. Heat the work
2. Cool in oil
3. Clean oil from surface
4. Heat in oven
5. Inspect under blacklight

As a solution to this problem, a triple counterflow rinse tank was designed to be fed with condensate from a Trichlorethylene vapor degreaser. This is shown diagrammatically in Figure No. 5.

The vapor degreaser served a double purpose. It was used for heating the work prior to dipping in the cold oil and it was essentially used as a still to feed clean solvent to the counterflow rinse. The overflow from the counterflow rinse was returned to the degreaser. All that was required was to occasionally recover the solvent and clean the oil from the degreaser.

The flow was not controlled, but only depended on the rate of collection of condensate within the degreaser. The average flow was approximately 5 gallons per hour which was enough to keep the final rinse tank clear as observed by eye.

(*Concluded on page 67*)

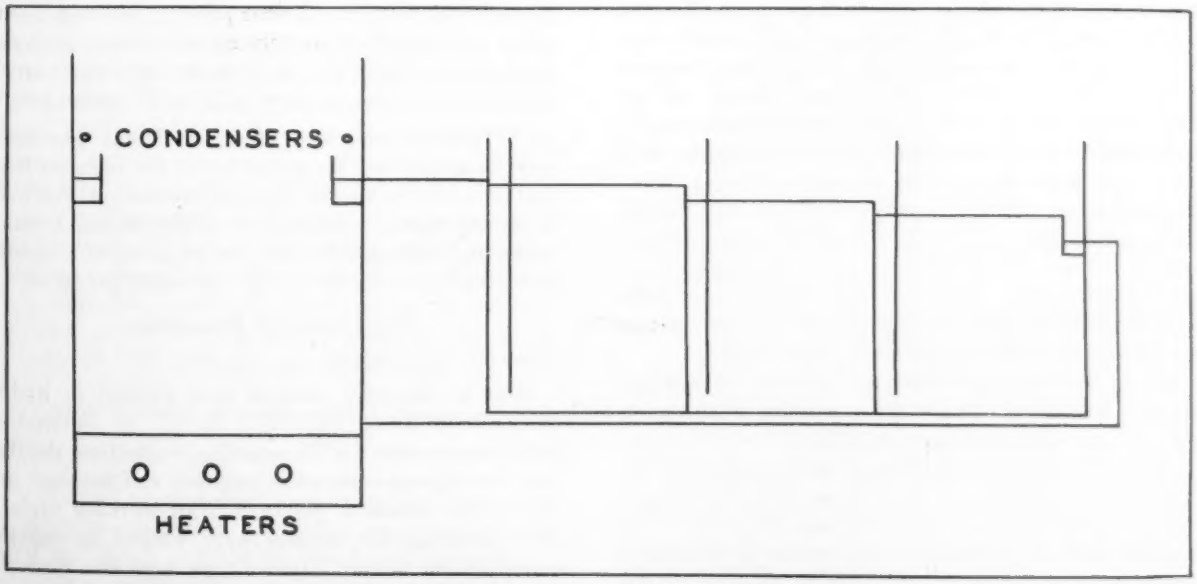


Figure 5. Design of triple counterflow solvent rinse tank.

The Role of Cyanide Neutralization in the Surface Treatment of Steel

By J. H. Peterson, G. M. Nichols and W. F. McDevit,

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Abstract

THE use of sodium cyanide in alkaline solutions for the neutralization of pickled steel is known to provide cleaner sheets which resist corrosion during storage and have an excellent surface for galvanizing or enameling. It was of interest to obtain more information as to the role of cyanide in this application.

The use of sodium cyanide labeled with carbon-14 has provided a rapid and direct way for determining the small amounts of cyanide retained on the steel surface.

It was found that the amount of cyanide on treated and dried steel was equivalent to about 5 milligrams of sodium cyanide per square meter of surface and was present mainly in the form of water soluble salts. The resistance of cyanide-neutralized steel to atmospheric corrosion was shown to result from the efficiency of alkaline cyanide solutions in producing chemically clean steel surfaces.

Neutralization After Pickling

The removal of mill scale from steel by pickling in dilute sulfuric or hydrochloric acid both during manufacture and preliminary to fabrication is standard practice in the metals industry. It is generally believed that in this process iron oxides are removed directly by the dissolving action of hydrochloric acid or indirectly by a combined under-cutting and lifting action due to hydrogen release when sulfuric acid dissolves the base metal. In the rinsing step, which normally follows the pickling process, excess acid and the dissolved products of the pickling reaction are washed off the steel surface. However, even when pickled surfaces are thoroughly rinsed, some iron salts remain on the steel and, when acted upon by the atmosphere, form objectionable stains. Alkalies, such as soda ash and caustic soda, are sometimes used to neutralize acidic surface residues. Although these compounds neutralize acids satisfactorily, they also react with soluble iron salts to precipitate insoluble compounds which have deleterious effects on further processing of the steel.

It has been shown[1,2] that the addition of a small amount of sodium cyanide to an alkaline neutralizing solution prevents the formation of these insoluble compounds and imparts a clean appearance to the neutralized steel. In addition, it has been noted in this laboratory and elsewhere that the resistance of cyanide-neutralized steel to atmospheric corrosion is increased over that of unneutralized or caustic soda-neutralized steel. In explanation of these effects, it has been proposed[1] that the sodium cyanide present in the neutralizing solution reacts with salts retained by the steel from the pickling solution to form soluble cyanide complexes, thereby preventing the precipitation of insoluble compounds and effectively eliminating iron ions from the surface through such complex formation.

In the course of an investigation of the enhanced corrosion resistance of cyanide-neutralized steel, it was of interest to determine (1) the quantity of cyanide retained on the steel surface if any, (2) the form in which it is retained, and (3) whether retained cyanide imparts any special corrosion resistance to the surface. Because of the low concentration of cyanide in the neutralizing solutions employed and the small maximum amounts which could possibly be retained, the use of sodium cyanide labeled with carbon-14 presented a way of making these determinations directly and easily.

Materials

The steel used in this investigation was SAE No. 1020, coated with a thin protective layer of electrolytic zinc that was readily removed in the pickling solutions. This steel was used because of convenience but the findings also apply to other types of sheet steel. When uncoated steel was used, the samples were vapor degreased with trichloroethylene prior to pickling. Treatments and activity measurements were made on 3 cm. diameter circular discs cut from the steel sheet stock. Corrosion tests were made on 1.75″ x 3″ treated panels.

The labeled sodium cyanide used was purchased from Tracerlab Inc. on allocation by the Isotopes Division of the U. S. Atomic Energy Commission. For most of the experiments, the activity of the sodium cyanide in the neutralizing solutions was adjusted to a specific activity of approximately 0.33 millicurie per gram.

Experimental Procedure

Pickling Treatment

Most of the steel samples were pickled in hydrochloric acid (conc. $HCl:H_2O = 1:1$ by volume) at room temperature for 15 seconds. In this time the thin zinc coating was completely removed and the steel surface mildly attacked, giving a clean working surface. After pickling, the samples were washed in running water for one minute. Limited tests were also made by pickling with 20% H_2SO_4 at 50°C.

*Contribution No. 336.

Neutralizing Treatments

In general the samples intended for subsequent activity measurements were neutralized at a solution temperature of 88-90°C. and a concentration of 1.5 grams each of sodium cyanide and sodium hydroxide per liter (0.2 oz. each per gallon). Other concentrations used and variations from this procedure are shown in Table I. In making the neutralizing treatments the pickled and rinsed steel discs were held in the solution for one minute and, upon removal, were allowed to drain and dry in a vertical position. Because of the relatively small sample size, the drop of solution collecting at the bottom edge of the sample discs was removed by touching to a paper towel and tapping lightly before the disc was set aside to dry. This was done in order to approach as closely as possible the conditions pertaining in the treatment of large sheets where the relative fraction of the solution which would not drop off the sample would be less than for a small disc such as used in these experiments.

Panels intended for corrosion testing were treated by various methods after pickling, ranging from a single water rinse to a careful rinse with boiling distilled water to neutralizations in several concentrations of NaOH, NaCN and Na_2CO_3.

Activity Measurements

Most of the activity measurements were made on the steel sample discs using a gas-flow internal sample type of counter. A few measurements on samples which were losing cyanide at a significant rate were made with a counting rate meter equipped with an end-window type counter tube. In all cases, the amount of cyanide in the samples was determined from activity measurements which were compared directly with those made on standard samples containing known amounts of cyanide. These standards were prepared by mixing a measured amount (usually 0.01 ml.) of the neutralizing bath with an excess of a dilute solution of nickel sulfate on a clean, dry steel sample disc, spreading the solution to cover uniformly the whole area of the disc and drying in a stream of nitrogen. The sample thickness in all cases was less than 0.1 milligram per square centimeter. Several different salts were tried as complexing agents for fixing the cyanide, including, those of iron, zinc and silver, but most satisfactory results were obtained with nickel. Standards prepared in this manner and stored in a desiccator exhibited little or no loss of activity over a period of several weeks. The activity level of the sodium cyanide in most of the runs was adjusted by addition of inactive material to give approximately 500 counts per minute per microgram of sodium cyanide. This made it possible to detect on a 3 cm. diameter sample disc an amount of cyanide equivalent to 0.02 microgram of sodium cyanide or of the order of 0.03 milligram per square meter.

Experimental Results and Discussion

Amount of Retained Cyanide

Pickled and washed sheet steel treated in a neutralizing solution containing 1.5 grams each per liter of NaOH and NaCN at 88-90°C. was found on drying in air to lose some 80 to 90% of the cyanide carried from the neutralizing solution. The amount of retained cyanide was equivalent to 4 to 6 milligrams of sodium cyanide per square meter. The amount of cyanide removed from the treating solution by the sheet steel averaged 42.5 milligrams of sodium cyanide per square meter of surface. Data are given in Table I. This loss during drying apparently is caused by displacement of cyanide by carbon dioxide picked up from the atmosphere. This was demonstrated by the fact that, when cleaned steel discs in a nitrogen atmosphere were coated with an amount of solution approximately equivalent to that carried from the neutralizing solution in a typical treatment and then dried under nitrogen, all the cyanide was retained. These dry samples on subsequent exposure to air, however, lost cyanide quite rapidly but at a slower rate than similar samples coated in air and dried in a stream of air. Data in Table I show that retention of cyanide was increased by increasing the solution concentration from 1.5 to 7.5 grams each of NaOH and NaCN per liter and to a lesser extent by increasing the NaOH concentration to 3 grams per liter. Drying of the samples in a stream of CO_2 in most cases caused only a minor decrease in the amount of retained cyanide which suggest that the major portion of the cyanide retained is in the form of metal complexes, although some may be held by occlusion.

Reflection electron diffraction photographs of the neutralized samples showed no lines which could not be identified with iron, sodium carbonate or gamma ferric oxide. Patterns obtained for samples neutralized

Table I

Retention of Cyanide by Neutralized Sheet Steel

Series No.	*Departure from Outlined Procedure**	*No. of Samples*	*Average Cyanide Retention mg./m² NaCN*	*Range mg./m² NaCN*
A.	None	17	5.0	4.0-6.0
B.	Dried in stream of CO_2	6	4.5	4.0-5.3
C.	Pickled for 5 seconds, dried in stream of CO_2	2	5.4	
D.	Pickled for 30 seconds, dried in stream of CO_2	2	5.1	
E.	Pickled for 1 minute, dried in stream of CO_2	2	5.7	
F.	Pickled for 2 minutes, dried in stream of CO_2	2	5.7	
G.	Neutralizing solution at 25°C., dried in stream of CO_2	4	1.7	1.6-2.0
H.	Neutralizing solution conc. 7.5 g. each of NaCN and NaOH per liter	6	17.5	13.2-23.7
I.	Same as H but neutralizing solution at 25°C.	4	13.3	10.8-15.3
J.	Same as I but dried in stream of CO_2	2	9.6	
K.	Neutralizing solution conc. 1.5 g. NaCN and 3.0 g. NaOH per liter	4	6.9	6.3-7.7

*Pickle for 15 seconds in HCl (Conc. HCl:H_2O = 1:1 volume) at room temperature, rinse for one minute in running water, stand in neutralizing bath at 88°-90°C. for one minute, dry in air at room temperature.

in the cyanide solutions were identical with those from samples neutralized in sodium hydroxide solutions.

Tests were also made in which glass discs of the same diameter as the steel samples were coated with known small amounts (0.01 to 0.05 ml.) of the neutralizing solution and then dried in air or in a stream of CO_2. These showed an average retention of only 3.8% of the total activity and differences between samples dried in air and in CO_2 were slight. This retention by glass may be explained by the presence of small amounts of metal ions capable of complexing cyanide on the surface of the glass and in the neutralizing solution. These differences in retention between glass and steel may be attributed at least in part to the presence on the steel of larger amounts of metal ions capable of forming stable cyanide complexes.

The amount of cyanide remaining on sheet steel sample discs at varying times after removal from the neutralizing solution was determined by fixing the cyanide with a slight excess of nickel sulfate solution followed by drying and counting. Average values obtained from a series of samples as given in Table II show that the loss was very rapid at first and fell to a low rate by the time the sample was essentially dry. This method, while it did not measure the change occurring on a single sample, was used because of the difficulty in following the very rapid changes in activity during the short drying time and in correcting for changes in self absorption during drying of the sample.

Following the initial rapid loss of cyanide there was a slow continuing loss on prolonged storage of the samples in the open air. The data given in Table III were obtained during the summer months under conditions of comparatively high relative humidity and appreciable rusting had occurred by the time the tests were terminated so that there may also have been some mechanical loss.

Because significant amounts of cyanide were found to be retained by pickled steel neutralized with alkaline cyanide solutions, it was pertinent to determine if the cyanide was present as an insoluble coating. Activity measurements made on a large number of samples, however, showed that only traces of cyanide remained after washing for one minute in running water either directly after neutralization or after drying. Measurements made on some 48 different samples showed an average retention of cyanide equivalent to 0.16 milligram NaCN per square meter with a range of values

Table II

Retained Cyanide on Sheet Steel After Varying Drying Times in Air

(Neutralizing Solution at 85-90°C.)

Time After Removal From Solution (Min.)	*Retained Cyanide Mg./m² NaCN*	*% of Amt. Removed from Solution*
0*	39	100
1	26	66.7
3 (sample essentially dry)	7.6	19.5
5	5.1	13.0
10	4.5	11.5

*Cyanide fixed with Ni^{++} within 10 seconds after removal from neutralizing solution.

Table III

Loss of Cyanide from Neutralized Sheet Steel on Indoor Storage

Sample No.	*Cyanide on Sheet Steel After Varying Periods of Indoor Storage Mg./m² NaCN*						
	Original	*1 day*	*2 days*	*6 days*	*13 days*	*22 days*	*56 days*
1A	5.0	4.6	3.9	3.4	3.2	3.1	2.5
2A	5.4	4.9	4.0	3.5	3.3	2.9	2.2
3A	5.3	4.9	3.9	3.3	3.2	2.8	2.2
4A	4.4	4.1	3.2	2.6	2.4	2.1	1.4

from <0.03 to 0.6 milligram. It is significant that half of the values were below 0.1 mg. per square meter. It appears improbable that this small amount of residual cyanide represents an insoluble uniform layer but it may be accounted for by material trapped in mill marks and micro rough areas on the surface of the steel.

Relation to Corrosion Resistance

Because of their qualitative nature, detailed results of corrosion experiments are not presented. Corrosion test methods were: (1) exposure to indoor laboratory atmosphere, (2) exposure to controlled atmospheres at 100% R.H. and 100°F. with and without the presence of 20 parts per million of sulfur dioxide. Two essential results of these experiments can be correlated with the above data on cyanide retention.

1. Steel surfaces that are rendered scrupulously acid free and chemically clean (free from heavy metal ions; in particular, ferrous ions) following the pickling step show no difference in corrosion resistance between those neutralized in sodium hydroxide solutions and those neutralized in sodium cyanide solutions. When the surfaces are allowed to remain alkaline, by not being rinsed after neutralization, corrosion resistance is improved under some conditions of exposure but again there is no difference between the effects of sodium hydroxide and sodium cyanide.

2. However, preparation of chemically clean surfaces following pickling is made easier when sodium cyanide is present in the neutralizing bath. This is particularly apparent when the surfaces are deliberately treated with dilute (0.005 molar) solutions of iron salts just prior to neutralization. If a minimum of 0.18% sodium cyanide was present, no stains appeared on neutralization of these presented surfaces, whereas in the absence of sodium cyanide brown stains of ferric hydroxide appeared in approximately 50% of the cases. Subsequent corrosion was found to be accelerated in the vicinity of these stains.

These results show that improvement in the temporary corrosion resistance of cyanide-neutralized pickled steel results entirely from the chemical action of the sodium cyanide during the neutralization step itself and not from any special corrosion preventing action of cyanide retained on the surface. This is in accord with the finding that a negligible amount of cyanide is retained in insoluble form.

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2. Shands, E. H., Bruton, G. L., and Grimes, G. J., J. Am. Ceram. Soc., **18**, 323 (1935).

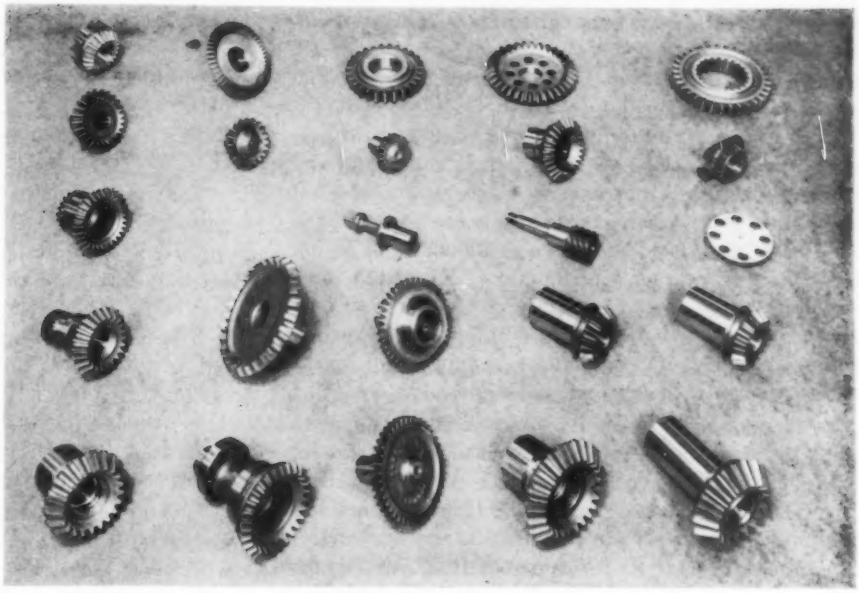


Figure 1. Groups of tank engine parts showing the diversity in size and shape of those deburred in barrels by Continental Motors Corp. All parts mentioned in the text, as well as some others not there mentioned, are shown.

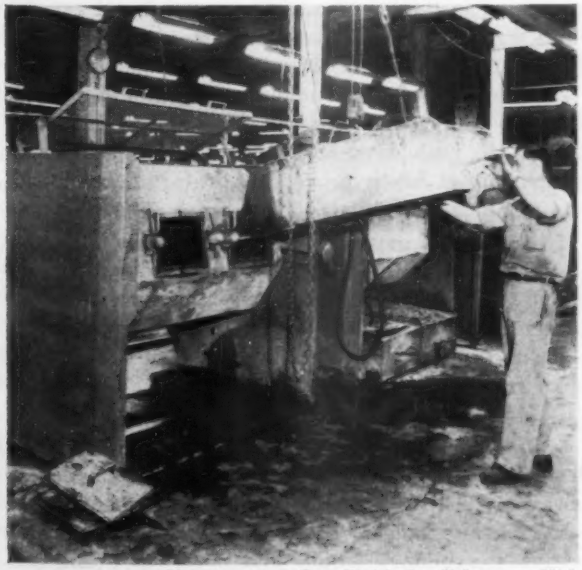
Deburring by Wet Tumbling

Finishing Tank Engine Parts at Continental Motors

By Herbert Chase

MARKED improvements in deburring practice plus important savings in labor charges have resulted from the application of modern barrel finishing methods, equipment and wet tumbling media to more than a score of different steel components for Army tank engines at *Continental Motors Corp.'s* Getty St. Plant, Muskegon, Mich. Five rubber lined barrels equipped with variable speed drives do an excellent job of deburring on these variously shaped steel parts with substantial savings over the hand deburring formerly done.

With the new setup, parts are handled in bulk lots of 75 to 400 pieces per batch, saving the former individual handling of each part separately, besides greatly reducing the labor per part. In general, labor savings range from 5 to 10 cents per part and a better and uniform deburring results. Besides the deburring itself, there is an improvement in surface finish of parts because of the scouring action that the abrasives



Photos courtesy Roto-Finish Co., Kalamazoo, Mich.

Figure 2. Operator charging one of the barrels with parts and granite chips from a pan that is handled by a trolley hoist. The same pan is placed below the barrel when the load is discharged.

Figure 3. Discharging a load of parts and chips after barrel deburring. Chips fall through the screen into the pan below for reuse. Parts remain on the screen until removed by hand.

employed exert on all exposed surfaces. Thus, an initial micro finish of 20 may be improved to one of 15, at the same time that sharp edges are slightly rounded and burrs are removed.

In this type of wet deburring, the parts remain submerged in the mixture of granite chips, compound and water. Barrel speeds are slow, hence parts are not thrown about in the barrel. Thus, there are no hard impacts or nicking but rather a gentle sloshing action that causes the abrasive to move relative to the work as deburring and scouring proceed. Cutting is chiefly on sharp edges, where burrs occur, but the scouring action on other surfaces tends to remove tool marks and consequently to improve smoothness.

As in all barrel finishing work, it is necessary to adapt the conditions, including the abrasives chosen, to the size and type of part and to the character of burrs to be removed. Heavy burrs, such as sometimes result if cutting tools are not kept adequately sharp, require a longer time for removal than for lighter burrs, other conditions being the same. For each size and shape of part, tests have determined what set of conditions yields best results and records are made accordingly, so that each batch of any particular part will receive the same treatment, if in the same initial condition.

Variables that have to be controlled (and are recorded so as to be duplicated for duplicate batches) include: Type, size and weight of granite chips, type and quantity of abrasive compound, number of parts per batch, speed of barrel rotation and duration of tumbling. The last of these depends upon burr conditions. If burrs are heavier than average, tumbling time may have to be increased.

In all cases, predetermined weights of chips and of parts are placed in barrel compartments and are covered with water. Then, a given weight of proper compound is added and the compartment covers are locked in place. In general, each compartment is about half filled. A proper barrel speed is chosen and set for the particular parts to be processed, after which tumbling is started and is continued for the prescribed time. When this time has elapsed, the barrel is stopped, compartment covers are removed and a hose is used to flush out the compartments before the load is discharged.

Loading and unloading are done from and to a hoist pan that, for unloading, rests on wheels for easy shifting along the floor. On the pan, a screen is placed to catch the parts while chips drop through the screen into the pan. Parts are then removed from the screen by hand into baskets for dipping into a rust inhibitor before transfer to other departments. A mechanically operated shaker screen will be used when installed. This will save handling, as the entire batch will then be shifted in the pan by hoist without prior screening below the barrel and screening will be mechanical.

Several of the parts that undergo barrel deburring are spur or bevel gears, some of which are integral with other parts. Hand deburring of such parts, even when a portable electric grinding tool is used, is a slow and tedious job and considerable skill is needed even for approximate uniformity. In the case of one bevel gear made integral with an eccentric, 75 parts are placed in the barrel along with 700 lb. of granite chips and 4 lb. of compound. Water enough to cover the load and stand 2 in. above it is then added and the compartment is closed. Tumbling continues at 15 rpm for 4 hrs. after which the barrel is stopped, the compartment is flushed out and the load discharged. Total labor required does not exceed ½ hr. for the batch and no special skill is needed.

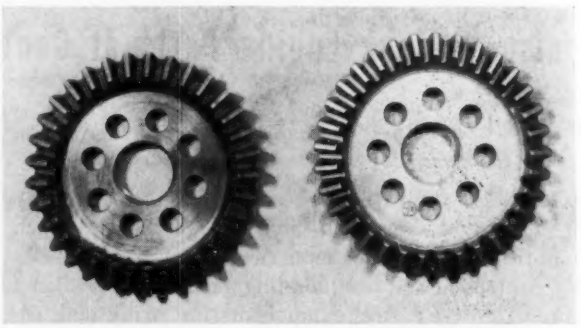


Figure 5. Closeup of two typical parts as they appear before and after deburring with granite chips, compound and water. Burr removal is uniform and also results in scouring, with improved smoothness on other surfaces.

Figure 4. Removing deburred gears from the screen onto which the barrel charge has been dumped. Parts removed by hand are placed in wire baskets for dipping in rust inhibitor.

In the case of parts called control levers, 500 pieces constitute a batch. 700 lbs. of chips and 4 lbs. compound plus water constitute the remainder of the charge. Tumbling is done for 4 hours at 20 rpm. Labor per part is almost negligible and the total charges per piece are small.

Spur gears of 3-in. dia. and having integral shanks 1¼ in. in diameter are deburred in lots of 125 per charge using 700 lb. of chips and 4 lb. of compound plus water. This charge is run 4 hr. at 15 rpm. In this case, the hub hole is splined after tumbling, partly because the splines are quite fine. Some other parts are splined before tumbling. Most parts are hardened before tumbling. Hard burrs break off more readily than soft burrs and, if any scale or discoloration results

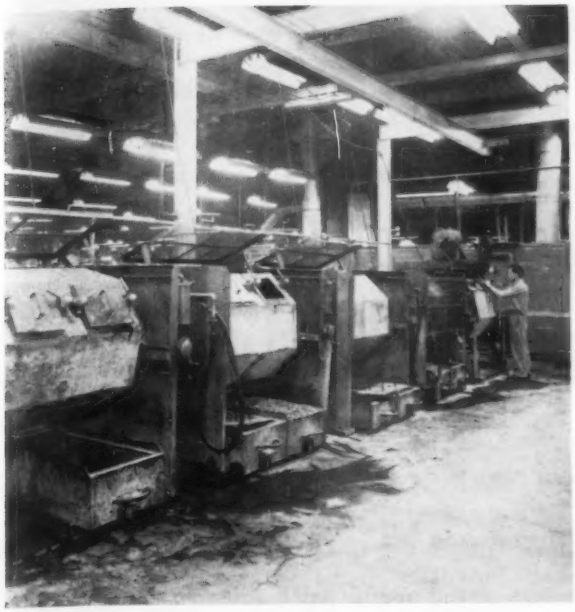


Figure 6. General view of the row of barrels used for deburring tank engine parts at the Continental Motors plant. Safety screens are lowered while barrels are rotating.

from hardening, they are removed in the tumbling process.

In general, the size of granite chips chosen is the largest that will reach all edges to be deburred and will not lodge in any hole or holes that are in the part. Wear on granite chips is slow but chips do become smaller in use and require regrading as to size, by screening, that also removes any small particles that may chip off. One function of the compound is to prevent chips from becoming glazed and thus losing their cutting power but the compound includes fine abrasives that also have a beneficial effect in the deburring action.

In certain instances, as in a part called a cam cover, mixed sizes of chips yield better results than a single size. Thus, for the cam cover, the charge includes 300 lb. of one size chips and 400 lb. of another, plus 4 lb. of compound and water. 400 of these parts are deburred per batch. Barrel speed is 20 rpm and total tumbling time is 4 hours.

Not all parts require a 4-hr. tumbling. Magneto drive gears, for example, are deburred in 3 hrs. at 20 rpm in batches of 400. In this case, 700 lb. of chips and 4 lb. of compound plus water complete the charge. Gears up to 4-in. dia. are among those deburred by the process. Larger parts can be done in some cases but parts that are large and heavy (and which have not been deburred by tumbling methods in this plant as yet) generally must be racked in such a way that impingement of part on part is prevented.

Most parts deburred as described in this plant are of SAE 8617, or, for carburizing, TS 8620 steel. All work is done in five barrels which are tended by one man per shift. He readily performs all loading and unloading besides doing such supplementary operations as chip handling (in hoist pans), chip separation, and dipping deburred parts in rust inhibitor. As the total number of parts deburred per shift is large, the labor charges per piece are exceedingly low.

COUNTERFLOW RINSE TANK DESIGN

(*Concluded from page* 61)

Conclusions

Although there are a number of steps involved the estimation of requirements, the design and the calibration of rinse tanks is a straightforward and relatively simple problem.

The most difficult decision to make is to decide what equilibrium concentration can be tolerated in the rinse. If the rinse follows an alkaline cleaner and precedes an alkaline plating bath then it is likely that little trouble will be expected due to contamination from the rinse. If the rinse follows a pickle and precedes an acid plating bath then in many cases it is desirable to obtain a low equilibrium concentration in the rinse to avoid drag-in of metals that will cause loss of plating quality due to co-deposition. If sufficient information is not available from previous experience then an arbitrary decision will have to be made until such time as the desired information is available. For the two examples given above, arbitrary values of 1 oz. per cubic foot and 0.01 oz. per cubic foot might be as good as any for a starting point.

If a rinse tank is designed with potential extra capacity and if it is calibrated, it may be possible to correlate data from the plating log with rinse flow and ultimately establish the most economic flow.

The following steps are recommended as an approach to the rinsing problem.

1. Decide on the desired limiting concentration in the rinse.

2. From the drag-in per rack, estimate the required flow from the dilution ratio, R. If the drag-in is not known it can easily be determined by use of a conductivity meter. If no reliable measuring means is available assume one fluid ounce per square foot of work.

3. If the flow is appreciable estimate the economies of a counterflow rinse.

4. Design, install and calibrate a flow meter so that a definite flow can be maintained.

5. Calibrate the rinse tank with a conductivity meter so that concentration in the rinse tank can be measured.

6. After the flow meter and the rinse tank are calibrated, determine the characteristics of the rinse tank by measuring the change in concentration with time, under full production conditions, by the use of a conductivity meter.

7. After the rinse tank has been running for some time, study the plating log to determine if the rinse tank is a source of contamination to the work or to the following bath.

If this suggested procedure is sound and if sufficient data are recorded, it should be possible to establish the dilution ratio for typical rinse applications. With such data available economic rinse tank design should be possible.

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Surface Treatment and Finishing of Light Metals

Part V. — Chemical Conversion Coatings

By S. Wernick, Ph.D., M.Sc., F.R.I.C., F.I.M., and R. Pinner, B.Sc.

METHODS of protecting aluminum and its alloys from corrosion which are based on the production of a chemical conversion coating have been known for some time, but it is only in recent years that they have grown in industrial significance. The most important coatings are of two types, based respectively on the thickening of the natural oxide present on aluminum surfaces, and the production of phosphates, usually aluminum or zinc phosphate. A third type of coating based on the production of a chromate film is of relatively minor importance, and has already been referred to in the preceding article in this series.

Function of Conversion Coatings

While the oxide conversion coat can be used without further treatment, in the main its function is to act as an undercoating and a base for organic finishes. It is normally considerably thinner than the oxide film produced by anodizing and for most protective applications the conversion coatings are, therefore, hardly competitive with anodic finishes. The thinner and also softer film, while adequate in many instances as a protection against corrosion, is not normally suitable if additionally it has to resist wear and abrasion. It is indeed possible to dye chemical oxide coatings but, again, the effects are in no way competitive with those obtained by dyeing anodized surfaces — the colors are not so attractive, nor is the light fastness so good. It has also been claimed that the conversion oxide coating can be used as a basis for the production of electrodeposits, but no commercially satisfactory process has been developed on these lines and the methods based on this procedure are not likely to produce such good results as can be achieved by using, for example, the zinc immersion process developed in recent years.

The main attraction of finishes obtained by chemical conversion is the economy and the speed with which they can be produced. The requirements involve plant of relatively simple construction, while no electric power is necessary, and the rapidity with which coatings can be produced on large number of articles brings the cost of the process down to a mere fraction of that of anodizing; despite this, adequate corrosion resistance and useful paint adhesion characteristics are imparted to the surface which are entirely sufficient for many applications. The finish can also be used as a temporary protective measure on aluminum articles which may require storage for any appreciable period.

While, thus far, the decorative aspect of the conversion coatings, as such, has been little explored, mainly because the initial finish is often rather unattractive in character and not readily colored, it may well be that further research along the lines of the German E.W. process may result in the production of coatings which depart from the normal uninteresting dark-gray appearance, producing a self-color finish on aluminum which would be considered more attractive and enjoy a special field of application.

Chemical Oxide Coatings

As is well known, the natural oxide film which forms when a freshly cut aluminum surface is exposed to the atmosphere is responsible for the comparatively high corrosion resistance of aluminum despite its electronegative character. The thickness of this film varies, depending on alloy composition and time of exposure, but is normally somewhere in the range of 2 to 6 micro-inches. It will withstand many corrosive influences and does not in itself form a good base for organic finishes such as paints or lacquers. By suitable chemical treatment, however, oxide coatings which are 100 to 200 times as thick are obtainable and, according to their formation and after treatment, such coatings are more or less porous and absorptive, forming a good key for organic finishes.

J. D. Edwards has well described the ideal protective coating as possessing the following properties[1]:

(1) It should be continuous or substantially so, and should be impervious to gases and liquids.

(2) It should be inert or almost insoluble in its environment; it must, therefore, possess low solubility in water, acids and alkalies.

(3) It should not electrolytically accelerate the attack on the base metal.

(4) It should be resistant to mechanical injury

such as abrasion or scratching or, if weak and thin, it should be self-repairing.

(5) It should bond readily with paints and other organic finishing materials.

It will be seen shortly how far the various chemical conversion coatings approximate to this standard.

History of Chemical Oxide Coatings

The possibility of strengthening the natural oxide coating on aluminum was first suggested as long ago as 1857 by H. Buff[2] and again by C. Pollak.[3]

The first chemical method, however, was developed in 1915, when O. Bauer and O. Vogel[4] suggested the oxidation of the metal in a solution containing:

Potassium carbonate	25 g./l.
Sodium bicarbonate	25 "
Potassium dichromate	10 "

for 2 to 4 hours at a temperature of 90 to 95° C.

This method produced at first a light-grey irridescent film which, with longer treatment, turned dark grey. The treated article was rinsed and dried. The process was used successfully on pure aluminum as well as aluminum-zinc (7 to 10 per cent Zn) alloys, but gave rather better protection on the former.

A development of the Bauer-Vogel process was patented in 1923.[5] In this process an aluminum compound was added to the solution as a catalyst to accelerate the process; the solution contained:

Potassium dichromate	3.3 g./l.
Calcined soda	13.3 "
Alum	1.0 "

A small piece of aluminum metal was also added to the solution. The bath was agitated and operated at 90 to 95° C. for ½ to 1 hour, after which the work was rinsed and dried.

The film formed by this method was claimed to protect the surface against corrosion in neutral salt solution, e.g., sea water, to be resistant to electric currents, and to adhere well even if the metal was bent at sharp angles.

A number of other processes were developed between 1922 and 1930, but it was not until 1930 that Dr. Gustav Eckert[6] developed a process which was rapid, simple and economical. This process is closely based on the original Bauer-Vogel process, employs a solution containing sodium carbonate and sodium chromate in a ratio of approximately 3 to 1, and was called by him the M.B.V. process (Modifizierter Bauer-Vogel Process). The operating time of the M.B.V. process is given as 3 to 5 minutes and, depending on alloy composition, produces light- to dark-grey coatings which form a suitable base for orgainc finishes, or, alternatively, may be yet further protected by sealing (by immersion in waterglass solution). This process is applied to aluminum and alloys low in copper.

Later developments of the M.B.V. process were the E.W.[7] and L.W.[8] processes developed by the Vereinigte Aluminium Werke A.G. These processes, though somewhat more costly in operation than the M.B.V. process, made it possible, however, to produce colorless coatings as well as to protect copper-containing alloys satisfactorily. The corrosion resistance of the film is also somewhat better than the M.B.V. coating, though the former is not suitable as a paint base. The solutions employed are based on the M.B.V. solution, but contain in addition either sodium silicate or disodium phosphate.

The Alrok process, developed in the U.S.A., and operated under patents held by the Aluminum Company of America produces coatings not dissimilar from those produced by the M.B.V. process. The solution consists of potassium carbonate and sodium dichromate and, after treatment, the coating is sealed in potassium-dichromate solution.

As will be seen from a subsequent bibliography, the number of processes suggested for the chemical oxidation of aluminum is extremely large. Many of these employ extremely complex solutions; others are unsuitable due to their longer time of treatment. It is proposed to describe in detail only such processes which, within the knowledge of the authors, have proved commercially valuable.

Theory of Chemical Oxidation

When aluminum is immersed in boiling water, the natural oxide film is increased in thickness, though only to a limited degree. This change can be represented by the anodic reaction:

$$Al \rightarrow Al^{3+} + 3e^-$$

while the cathodic reaction, i.e., hydrogen evolution:

$$3H_2O + 3e^- \rightarrow 3OH^- + 3H$$

renders the solution more alkaline, the hydroxyl ions then reacting with the ionized aluminum to form the hydroxide.

$$(1) \qquad Al^{3+} + 3OH^- \rightarrow Al(OH)_3$$

The oxidation of aluminum in the presence of water will, however, stop after a certain thickness is reached, as the coating is non-porous and will not allow the passage of the solution to the metal surface. To obtain thicker coatings it is necessary, therefore, to include in the solution compounds which will have a slight dissolving action on the coating, and facilitate entry of the solution. This can be achieved either in acid or alkaline solution, though in practice if the hydrogen-ion concentration of the solution is too great or small, its attack on the aluminum hydroxide will be too rapid.

Commercially suitable solutions are, therefore, of two kinds. The first type consists of inhibited alkaline solutions, while, in the second type, weak acids, such as hydrofluoric, fluosilicic, chromic or tartaric acids, which form complex ions, are employed.

Dealing now with the theory of the inhibited alkaline solutions as used in the M.B.V. and Alrok processes and their modifications, as stated above, the basic reaction is probably the reaction of water on aluminum. In practice, the reactions involved are, however, very much more complex and will depend on the nature of the inhibitor as well as the alkali.

In solutions containing chromate, secondary reactions of the chromate on aluminum may, according to M. Schenk,[10] result in the production of aluminum oxide as well as chromic oxide.*

$$(2) \quad 2\,Al + 2Na_2CrO_4 \rightarrow Al_2O_3 + 2Na_2O + Cr_2O_3$$

*The composition of the aluminum oxide coating lies somewhere between Al_2O_3 and $Al(OH)_3$, both forms of which may, according to convenience, be used in this text.

Schenk shows, however, that this process is only a secondary one, i.e., that the chromate is not the oxidizing agent of the main reaction.

Helling and Neunzig[11] state a chemical for the oxidation reaction mechanism. According to these authors, the sodium carbonate present in the M.B.V. solution reacts with aluminum to form sodium aluminate.

(3) $2Al + Na_2CO_3 + 3H_2O \rightarrow 2NaAlO_2 + CO_2 + 6H$

the sodium aluminate then being partly hydrolyzed.

(4) $2NaAlO_2 + H_2O \rightarrow Al_2O_3 + 2NaOH$

the net result being the same as equation (1), as in the alkaline solution the carbon dioxide produced in (3) will reform the original sodium carbonate:

$$CO_2 + 2NaOH \rightarrow Na_2CO_3 + H_2O$$

This fact, as well as the presence of the carbon dioxide (probably in the form of sodium bicarbonate) available for reaction with any free sodium hydroxide produced by reaction (4) would make it probable that the hydrolysis reaction (4) actually goes to completion.

The reduction of sodium chromate takes place, according to Helling and Neunzig, by the action of the hydrogen evolved in reaction (3), presumably by the simple equation.

(5) $2Na_2CrO_4 + 6H \rightarrow Cr_2O_3 + 2Na_2O + 3H_2O$

Little definite is, however, known as yet of the mechanism of this reaction, and it is difficult to say to what degree reaction (2) and (5) actually takes place. Certainly it is known that during the M.B.V. reaction there is evolution of hydrogen, though the volume of hydrogen evolved has not, to the authors' knowledge, been determined. A determination of this kind, together with analysis of the coating (i.e., the aluminum: chromium ratio) would probably throw further light on this question.

Important properties such as the thickness, porosity and properties of the coating depend on the nature of the inhibitor.

As will be seen later, these properties are closely dependent on the operating conditions of the process, particularly the bath temperature.

The M.B.V. Process

The original M.B.V. solution as described by G. Eckert, contains:—

Sodium carbonate (anhyd.) 2 to 5 per cent (opt. 5 per cent)

Sodium chromate (anhyd.) 0.5 to 2.5 per cent (opt. 1.5 per cent)

and is operated at between 90° C. and 100° C. for 3 to 5 minutes. After treatment, the work is rinsed in hot or cold water and dried.

The concentrations of the constituents are not critical, but will influence the time of treatment required. With age, as the concentrations decrease, treatment time is increased until, even the work requires about 20 minutes, the solution is discarded. The life of the solution was estimated by Eckert as being capable of treating approximately 150 to 160 sq. ft. per gallon, though a rather lower figure, 50 sq. ft. per gallon, is given elsewhere.[12]

In practice, many different ranges of composition are used in different plants, and the operating conditions will depend on alloy composition, after-treatment, etc. It is advisable to determine the optimum conditions separately for each specific operation.

Electrical conductivity experiments on M.B.V. coatings obtained on L33 diecastings[13] showed that the highest electrical resistance and probably the optimum corrosion resistance were obtained at Eckert's concentration range, when the bath was operated at 100° C. for 5 minutes. It has been claimed, however,[12] that (for no apparent reason), better results are obtained when potassium chromate replaces the sodium salt, as follows:—

Sodium carbonate	8 oz.
Potassium chromate	3 oz.
Distilled water	1 gal.

the solution being worked at a gentle boil for 10 to 15 minutes.

As an alternative to immersion, Eckert suggests also the possibility of applying an M.B.V. paste, containing:

Sodium chromate (anhyd.)	10 pts. by wt.
Sodium carbonate (anhyd.)	4 " " "
Sodium hydroxide	4 " " "
Water	10-15 " " "

The paste is brushed on, left for 10 to 15 minutes and rinsed off. This method of application has, however, more recently been criticized[14] on the grounds that it is difficult to obtain uniform coatings.

Opinions also differ regarding the purity of the chemicals employed in the process. It is probable that today ordinary commercial-grade chemicals are sufficient, though formerly, and in regions where the commercial quality is doubtful, it was recommended that pure chemicals should be used.

Hard water must, however, be avoided, as its use may lead to a finish which may be patchy or dull, or show white precipitation spots of lime which is loosely adsorbed on the metal surface and detracts both from the appearance and the corrosion resistance of the work. Water should be tested and, if not sufficiently soft, may be wholly or partly replaced by distilled water or rain water, which should contain not more than 30 grains per gallon total solids.[12]

Equipment for M.B.V. Process

The M.B.V. process is the earliest of the commercial chemical oxidation processes developed for aluminum, and several processes have been developed from the composition of the original solution. A description of the necessary equipment, pretreatments and the influence of the operating conditions in connection with the M.B.V. process, will largely also apply to other processes, particularly the E.W. processes, the L.W. and Pylumin processes, and the Alrok processes, all of which are based on the alkaline carbonate-chromate bath, though they have important points of difference in their methods of application. Tanks to contain M.B.V. solution may be constructed from wood, welded sheet iron or mild steel, or enameled material, but should not be of galvanized or tinned iron. Copper-containing materials should also be avoided.

Any form of heating may be applied, though care

must be taken in the use of direct gas flames, since there is obvious risk of explosion with the evolved hydrogen.

M.B.V. tanks, like all tanks used for solutions containing substantial amounts of chromates, should be fitted with exhausts along two or preferably all four sides, and operators should wear rubber aprons, boots and gauntlets. If iron or steel tanks are employed, the distance between the work and the tank should not be less than three inches. Work is racked, wired, or placed in baskets, according to size, and this equipment may generally be of iron or steel. Baskets may also be of aluminum.

Influence of Pretreatments

The M.B.V. solution, as well as coating the aluminum surface, acts as an alkaline cleaner, due to its composition, and with work that is moderately clean, pretreatment is often unnecessary. Where parts are heavily contaminated with oil and grease, however, they should be put through the vapor degreaser, or a solvent emulsion cleaner, while some workers prefer to use an additional light alkaline cleaner in order to avoid undue contamination of the M.B.V. solution. The work should be well rinsed, preferably in two hot-water tanks between the degreaser and the M.B.V. tank.

Table I.[15]

Alloy Composition in per cent	*Coating**	*Casting skin not removed.*		*Casting skin removed.*	
		Appearance	*C.R. after 60 days in Permutit fog*	*Appearance*	*C.R. after 60 days in Permutit fog†*
Al 99.2	A	—	Local C spots.	—	Local C. spots.
Si 0.36	B	Metallic, green.	Unchanged.	Light grey.	Unchanged.
Fe 0.41	C	Uniform, slightly matt white.	Unchanged.	Iridescent.	Unchanged.
Al 99.5	A	—	Local C spots.	—	Local C spots.
Si 0.16	B	Metallic, green.	Unchanged.	Light grey.	Unchanged.
Fe 0.27	C	Uniform, slightly matt white.	Unchanged.	Iridescent.	Unchanged.
Al 99.8	A	—	Matt, white, spotty, no deep attack.	—	Matt, white, spotty, no deep attack.
Si 0.88	B	Light grey.	Unchanged.	Light grey.	Unchanged.
Fe 0.11	C	Uniform, slightly matt white.	Unchanged.	Iridescent.	Unchanged.
Al 99.98	A	—	Matt white, spotty.	—	Local small holes.
Si 0.0030	B	Metallic, slightly milky.	Unchanged.	Grey, white.	Unchanged.
Fe 0.0048	C	Metallic, slightly milky.	Unchanged.	Slight iridescence.	Unchanged.
Silumin.	A	—	Occasional small holes.	—	Local strong C. spots.
Si 12.05					
Fe 0.18	B	Spotty, light & dark grey.	Occasional spots.	Uniform dark grey.	Occasional spots.
Al remainder	C	Metallic, light, slight iridescence.	Occasional spots.	Metallic, light, slight iridescence.	Occasional spots.
Al-Mg 3	A	—	Local C. spots.	—	Local C. spots.
Mg 3.21	B	Metallic, slightly greenish.	Unchanged.	Spotty, metallic, light, slightly green.	Unchanged.
Si 0.17					
Fe 0.13	C	Unchanged.	Unchanged.	Unchanged.	Unchanged.
Al remainder					
Al-Mg 7.	A	—	Local C. spots.	—	Local C. spots.
Mg 6.57	B	Metallic, lightly matt white.	Unchanged.	A little spotty, otherwise unchanged.	Unchanged.
Si 0.22					
Fe 0.33	C				
Al remainder					
	C	Unchanged.	Unchanged.	Unchanged.	Unchanged.

*The words Corrosion and Corrosion Resistance in this Table have been abbreviated to C. and C.R. respectively.
†A = Without treatment.
B = M.B.V. treatment and waterglass seal.
C = E.W. treatment.

Table II.

Influence of Roughness of Aluminum Casting on M.B.V. Coating

Alloy Composition in per cent	*State of Surface*	*APPEARANCE*	
		With casting skin	*Casting skin removed*
Al 99.2 Si. 0.36 Fe 0.41	Fine. Coarse.	Grey-green, metallic, spotty. " " " "	Grey-green. Green, metallic, spotty.
Al 99.5 Si 0.16 Fe 0.22	Fine. Coarse.	Grey-green, metallic, spotty. " " " "	Uniform dark grey. Grey-green, locally light, spotty from large grain size.
Al 99.8 Si 0.08 Fe 0.11	Fine. Coarse.	Milky-grey, metallic, spotty. " " " "	Uniform light grey. " " "

Depending on the state of the metal and the operations carried out on it (i.e., heat-treatment, etc.) it may be desirable to remove oxide films in an acid solution in order to promote uniformity of the coating. In itself, the condition of the surface is, however, not critical to the protective value of the coating. Experiments carried out on M.B.V. and E.W. coatings on aluminum and aluminum-alloy castings,[15] showed that when applied to untreated castings, adequate corrosion resistance was obtained, though the presence of the casting skin had a marked effect on the appearance and color of the film. Results obtained with various alloys are given in Table I.

Apart from appearance, the condition of aluminum coatings is important also when the surface is to be dyed[16] or copperplated.[17] In the latter case, the presence of a casting skin leads to porous deposits on aluminum and the magnesium-containing alloys. No trouble was experienced, however, in the deposition of copper on silicon alloy.

The influence of the mechanical finish of the surface was also investigated by Helling and Neunzig and the results (Table II) show that the appearance of aluminum castings on M.B.V. treatment is largely dependent on the polish obtained.

It seems, therefore, that where the appearance of the surface is important, castings and rough wrought-metal surfaces should, where possible, be polished prior to treatment. A fine-grain structure is particuly important also where the work is to be dyed, or polished, or both.

If the M.B.V. coating is to be left in its natural grey color, an attractive appearance may result from the visibility of the grain of the metal,[18] though care in selection of the quality of the metal and mechanical finishes must be taken for, as in anodic oxidation and electropolishing, the M.B.V. treatment tends to expose rather than conceal blemishes such as drawing marks, scratches, etc., on the surface. Where the metal is badly marked, this fault may be avoided either by mechanical polishing or a short dip for 20 to 30 seconds in a hot solution of 1 lb. per gal. sodium hydroxide, followed by a cold nitric-acid dip, prior to M.B.V. treatment.[12]

Table III.

Effect of Alloy Composition on Color of Dye

Time of Treatment	*Dye*	*Color produced*	*Alloy*
2 min.	$KMnO_4$ 4 g./l. M.B.V. soln. 90 to 95° C. ½ min.	Light yellow brown. Grey-green Yellow-brown, slightly greenish	Al-Mn. Al-Mn-Mg-Si (Pantal) Al-Si
10 min.	As above but for 10 min.	Brown-red Dark brown Copper-tone	Al-Mn Al-Mn-Mg-Si Al-Si
1½ min.	$Cu(NO_3)_2$ 25 g./l. $KMnO_4$ 10 g./l. HNO_3 (65 per cent) 4 ml./l. 80° C. 2 min.	Light brown-red Dark yellow-brown Dark yellow-brown	Al-Mn. Al-Mn-Mg-Si Al-Si
10 min.	$Co(NO_3)_2$ 25 g./l. $KMnO_4$ 10 g./l. HNO_3 (65 per cent) 4 ml./l. 80° C., 10 min.	Deep black Deep black Deep black	Al-Mn Al-Mn-Mg-Si Al-Si

Effect of Alloy Composition

The M.B.V. process is most effective when applied to aluminum and its alloys with magnesium, manganese and silicon. It may be effective also on certain copper-containing alloys. On duralumin-type and other high copper-containing alloys, as well as alloys containing larger amounts of other heavy metals, M.B.V. coatings tend to be powdery, though thin coatings produced by 1 to 1½ minutes' treatment and left unsealed may be sufficiently firm to form a paint base.[18]

The composition has also a pronounced effect on the color of M.B.V. films. Coatings on pure aluminum, for example, are lustrous and very light grey, while that on certain alloys may be dark grey to black. The film is due to the presence of chromic hydroxide and the oxides of alloying elements. On the other hand, coatings on aluminum castings are not always as grey as on wrought materials,[15] while the color of coatings on aluminum-magnesium alloys, which contain magnesium nitride[10] in addition to the oxides, depends on the magnesium content. Coatings on alloys containing 2 to 3 per cent Mg. are lustrous but darker than those on aluminum while, with increase in magnesium content to 5 to 7 per cent, the coating increases in lustre, loses its color and tends towards iridescence, the coating often being almost invisible without, however, losing their protective quality. Similarly, the thickness of the coating will depend on the magnesium content of these alloys, a maximum thickness being obtained as the magnesium content is increased, after which the thickness falls off (see Fig. 1).

On duralumin, on the other hand, the M.B.V. coating has a matt, mother-of-pearl finish, or alternatively, is dark, almost black, while that on the 10 per cent silicon alloy is dark grey, dull and may sometimes show the presence of a loose, superficial film.

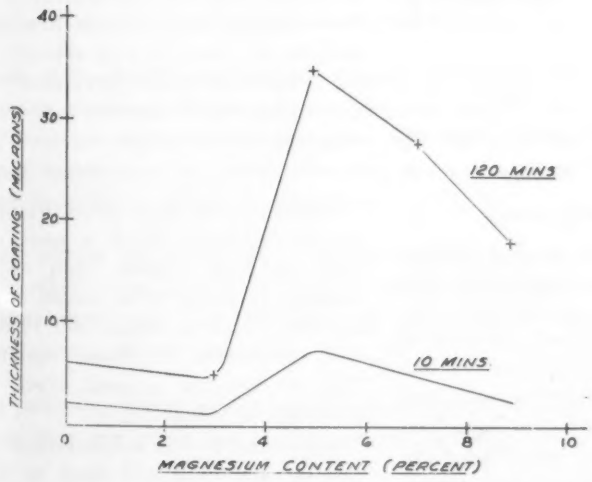

Figure 1. Effect of magnesium content on thickness of M.B.V. coating on Al-Mg alloys at 10 and 120 minutes.

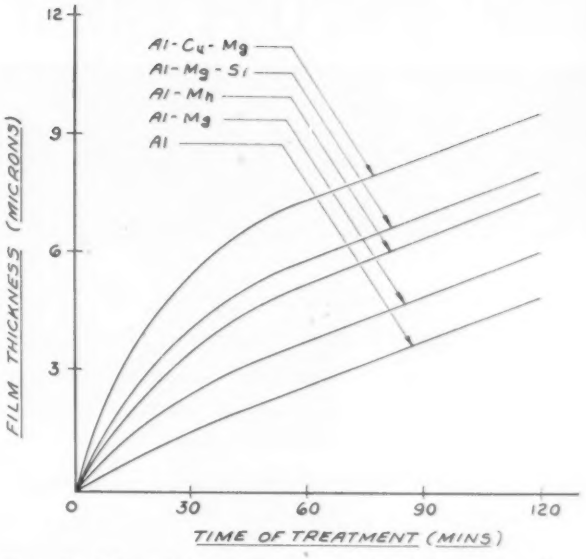

Figure 2. Effect of time on thickness of M.B.V. coating on different alloys.[26]

The effect of the alloy composition on the film thickness will be seen from Fig. 2, while Table III describes the effect of alloy composition on the color produced by dyeing the coating.

The most attractive coatings are obtained on aluminum and the aluminum-manganese and aluminum-magnesium alloys, though on more complex alloys the process is still valuable preparatory to organic finishes, which are not adherent on the untreated alloy surface but tend to age rapidly and become brittle.

The color of the coating is dependent also largely on the composition of the M.B.V. solution. On the higher aluminum-magnesium alloys, for example, the normal dark-grey coating may be obtained by the addition of 10 g./l. sodium hydroxide to the bath, the coating being produced at the low temperature of 60 to 70° C. The corrosion resistance of these coatings is, in general, however, slightly lower than those produced in the normal M.B.V. solution.

Sodium hydroxide additions are also frequently made to baths where no heating is available, and aluminum-magnesium alloys may be treated at room temperature in a solution containing:[20]

Sodium hydroxide	5	per cent
Sodium chromate	1.5	" "

the operating time being extended to 30 to 40 minutes.

(To be continued)

Shop Problems

Abrasive Methods—Surface Treatments—Control
Electroplating—Cleaning—Pickling—Testing

METAL FINISHING publishes, each month, a portion of the inquiries answered as a service to subscribers. If any reader disagrees with the answers or knows of better or more information on the problem discussed, the information will be gratefully received and the sender's name will be kept confidential, if desired.

Three-Tone Finish

Question: We desire information on the method of manufacturing of the enclosed sample. We would like to know the sequence of operations in the press and plating; and especially on the removal of the silver from the lettering.

G. K. S.

Answer: The finish on the sample forwarded is produced as follows:

1. Satin finish with greaseless compound.
2. Emboss the lettering. This produces the satin finish in the recesses.
3. Color buff with a hard wheel to produce the polished letters.
4. Silk screen paint the design which is to remain in brass finish.
5. Silver plate.
6. Satin finish background, using the paint as a mask for the polished letters.
7. Remove the paint.

Determining Small Amounts of Cyanide

Question: Would you be good enough to provide the undersigned with a volumetric analysis method for the determination of the cyanide content in the effluent of a plating department. Plating solutions employed are the regular barrel and still cyanide cadmium, zinc and copper. Dilution of the effluent is highly satisfactory so that the NaCN concentrations will probably run low.

W. J. B.

Answer: Determination of minute amounts of cyanide is by a modified Liebig titration using p-dimethyl-aminobenzalrhodamine as indicator. The complete procedure will be found in an article by Serfass, Freeman, Dodge and Zabban, which appeared in Plating, *39*, 267 (1952).

Electropolishing Tungsten

Question: We would appreciate having any information you may have on electropolishing tungsten. For our application the solution to be used could not rise above 300°F. as the tungsten to be polished will be brazed to a copper piece, which in turn would be inside of a glass bulb, so the solution cannot react with the glass, and cannot react too much with the copper.

H. L. H.

Answer: Our files show only one procedure, suggested by Hughes & Coomes (Physics Rev., **55**, Section 2, 1939), as follows:

Caustic soda	10%
Water	90%

Room temperature, 30-60 amp./sq. ft. for 20-30 minutes.

Nickel Plating Guns

Question: We are having trouble with the nickel plate popping off gun cylinders when the gun is fired. The nickel does not peel from the end of the barrel, or from the rest of the gun. We have tried plating with and without a copper strike, and have used sulfuric and muriatic acid dips without success. The cylinders are greaseless compounded and buffed to a mirror finish with stainless compound.

L. V. T.

Answer: The cylinder expands when the gun is fired and the nickel will pop off if the adhesion is not perfect. The trouble may be due to the high polish on the steel. We would suggest that you eliminate the buffing of the steel or else clean anodically, rinse, pickle anodically in sulfuric acid for 1 minute (a sulfuric acid nickel strip is good) at 6 volts, rinse, dip in 50% muriatic acid, rinse and direct nickel plate. A copper strike should not be used.

Cracking of Plated Brass

Question: Under separate cover we are sending you two samples of plated articles with copper strike, nickel and chromium on them. As you can see, the plating is full of hairline cracks which seem to occur only on brass stampings and articles made of rod brass. These particular ones were returned to our factory about two years ago. It seems that this cracking does not appear in our plating until one month to one year after it has been plated and then never to cast brass. This leads us to believe it might be stress in the brass.

Could it be a combination of stress in our nickel and the yellow brass, due to the fact we plate thousands of cast brass articles each day in this nickel and never have any cracking? We have had this trouble periodically for three years and it appears now we are running into it again.

E. B.

Answer: Our first guess would be season cracking, which is more common on high brasses than on low brasses. If stress is the cause, annealing for 1 hour at about 500°F. is the best treatment. If brass containing 15% or less zinc is used, cracking is generally avoided.

Exposure to an environment containing ammonia will tend to cause this condition and, naturally, stresses introduced by the nickel deposit will have some effect.

Passive Nickel

Question: I have been having trouble with my chromium solution for the past two weeks. When I plate over bright nickel or buffed nickel the work comes out spotty and gray, as if it were burnt, but it isn't burnt. If

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I use direct current in 5% sulfuric acid with lead anodes, the results are much improved. Would impurities be the cause of my trouble?

A. A.

Answer: The trouble is passivity of the nickel. In some cases activators will help. These are produced by Frederick Gumm Chemical Co., Kearny, N. J. and by Udylite Corp., Long Island City, N. Y.

The condition is not only minimized by direct current in sulfuric acid but in any solution. You can also use direct current in a solution of 8 oz./gal. sodium cyanide or in the cleaner, followed by a dip in a 20% solution of sulfuric acid.

Oxalic Acid Etching

Question: Several years ago I read an article in METAL FINISHING magazine regarding anodic etching of steel in oxalic acid prior to chrome plating in place of chromic acid. Are tear sheets or copies of this article available, and if so would you please send me a copy of the article?

A. K.

Answer: The oxalic acid etch treatment was described by G. R. Makepeace in METAL FINISHING, **43**, 364-7 (Sept. 1945). We regret that we do not have tear sheets available, but photostats can be purchased from the New York Public Library, New York City, or the John Crerar Library, 86 East Randolph St., Chicago 1, Ill.

Detecting Copper Flash with the Microscope

Question: We are a job plating shop specializing in English bronze. About two months ago we were called upon to put an English bronze finish on a large number of steel bed lamps. The specifications were as follows: 1. copper flash; 2. brass plate; 3. oxidize the brass. The work was done according to specifications and the finished lamps were then sent out to be tested. The testing company reported back that the copper flash was not observed under the microscope.

We know that a copper flash was placed on the work. Will a copper flash plated at .000001" be detectable under a microscope, especially after being plated with brass and then oxidized? Is it possible that the copper flash could have been absorbed by the brass plate or by the oxidizing agent which was liver of sulphur?

We trust that through your wealth of plating information you will be able to give us the answers that we seek.

J. W. B.

Answer: A deposit of 0.000001" will not be detectable under the microscope since the resolution of the instrument is about 0.00002". The copper flash would not be absorbed into the brass deposit under normal treatment, nor would it be absorbed into the steel base.

Gold Extraction

Question: We are attempting to extract gold by electroplating. The state law forbids the use of cyanide. What other compound is used in place of cyanide?

J. M. M.

Answer: Gold can be extracted from a gold chloride solution, acidified with hydrochloric acid and using carbon anodes. This is a standard method of refining. An exhaust will be necessary, however, since chlorine fumes are evolved in use.

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PATENTS

Vacuum Metallizing

U. S. Patent 2,665,227. *Jan.* 5, 1954. *P. J. Clough and P. Godley 2nd, assignors to National Research Corp.*

In a process for coating a moving substrate with aluminum by vacuum-evaporating said aluminum and condensing said aluminum on said moving substrate, the improvement which comprises the steps of feeding aluminum to a groove in the upper surface of a generally cylindrical elongated heated surface, said feeding being at a rate sufficient to maintain molten aluminum on said surface at substantially all times during coating, providing on said surface at least a stratum comprising a compound selected from the group consisting of the carbides and nitrides of titanium, zirconium, hafnium, vanadium, columbium and tantalum, said compound being wettable by, and substantially inert to, molten aluminum at temperatures on the order of 1300° C. to cause said aluminum to spread out in a thin extended layer of substantially greater size than the groove to which the aluminum is fed so that substantially all portions of said surface in position to radiate substantial quantities of heat to the substrate are covered by molten evaporating aluminum, heating said surface and the aluminum thereon to a temperature sufficiently high to evaporate the aluminum, and moving said substrate past said surface in a generally curved path to expose the substrate to aluminum vapors generated on the sides, as well as the top, of said elongated cylindrical surface to deposit a coat of aluminum on the substrate.

Conversion Coating

U. S. Patent 2,665,232. *Jan.* 5, 1954. *R. A. Neish, assignor to U. S. Steel Corp.*

In a method of retarding the formation of white rust on zinc surfaces, the steps including applying to the surfaces a dilute aqueous solution of an alkali-metal salt of chromic acid and sodium silicate, and drying the applied solution to form a microscopic film on said surfaces.

A solution for the treatment of zinc-surfaced articles to retard the formation of white rust thereon consisting essentially of from 10 to 40 ml. of about 40° Bé. waterglass per liter of solution, from .1 to 1% of an alkali-metal salt of chromic acid and the balance water.

Apparatus for Electropolishing Metals

U. S. Patent 2,665,247. *Jan.* 5, 1954. *J. F. Jumer.*

Apparatus for electro-polishing the interiors of metal containers comprising a reservoir, a pair of spaced parallel conductive means extending over the reservoir between the edges thereof, each adapted to support a row of containers to be polished, a support above the reservoir, spaced yokes journaled on the support on an axis parallel to said conductive means, spaced metal pipes parallel to said conductive means extending between said yokes and each provided with a plurality of openings, each opening being above one of the containers, metal electrodes depending from the pipes for immersion in the containers, said yokes and pipes being disposed and arranged for rocking movement on said support for first raising the electrodes on one of the pipes above one of said rows of containers and then lowering the electrodes on the other pipe into the other row of containers, means for forcing electrolyte from the openings in one of the pipes into the corresponding row of containers, and means for passing a direct current between the electrodes and said containers.

Vacuum Metallizing

U. S. Patent 2,665,320. *Jan.* 5, 1954. *E. E. Chadsey, Jr., P. J. Clough and P. Godley 2nd, assignors to National Research Corp.*

For use in an apparatus for the vapor deposition coating of a flexible substrate by moving the substrate past a source of metal vapors positioned in an evacuated coating chamber, a crucible for holding molten metal to be evaporated, said crucible comprising a material substantially inert to such molten metal and wettable by said molten metal, said crucible having a main body portion for holding said molten metal, lip means extending from said main body portion adjacent the upper edge thereof, and means for heating said crucible to thereby raise the temperature of said molten metal in said crucible to above 1,200°C., said heating means comprising a first heating portion for heating said crucible body and a second heating portion for heating said lip means, said second heating portion being arranged to apply a sufficient heat input to said lip means to maintain said lip means at a substantially higher temperature than the temperature of the molten metal in the crucible so that said lip means serves to vaporize all molten metal reaching said lip.

Vacuum Metallizing

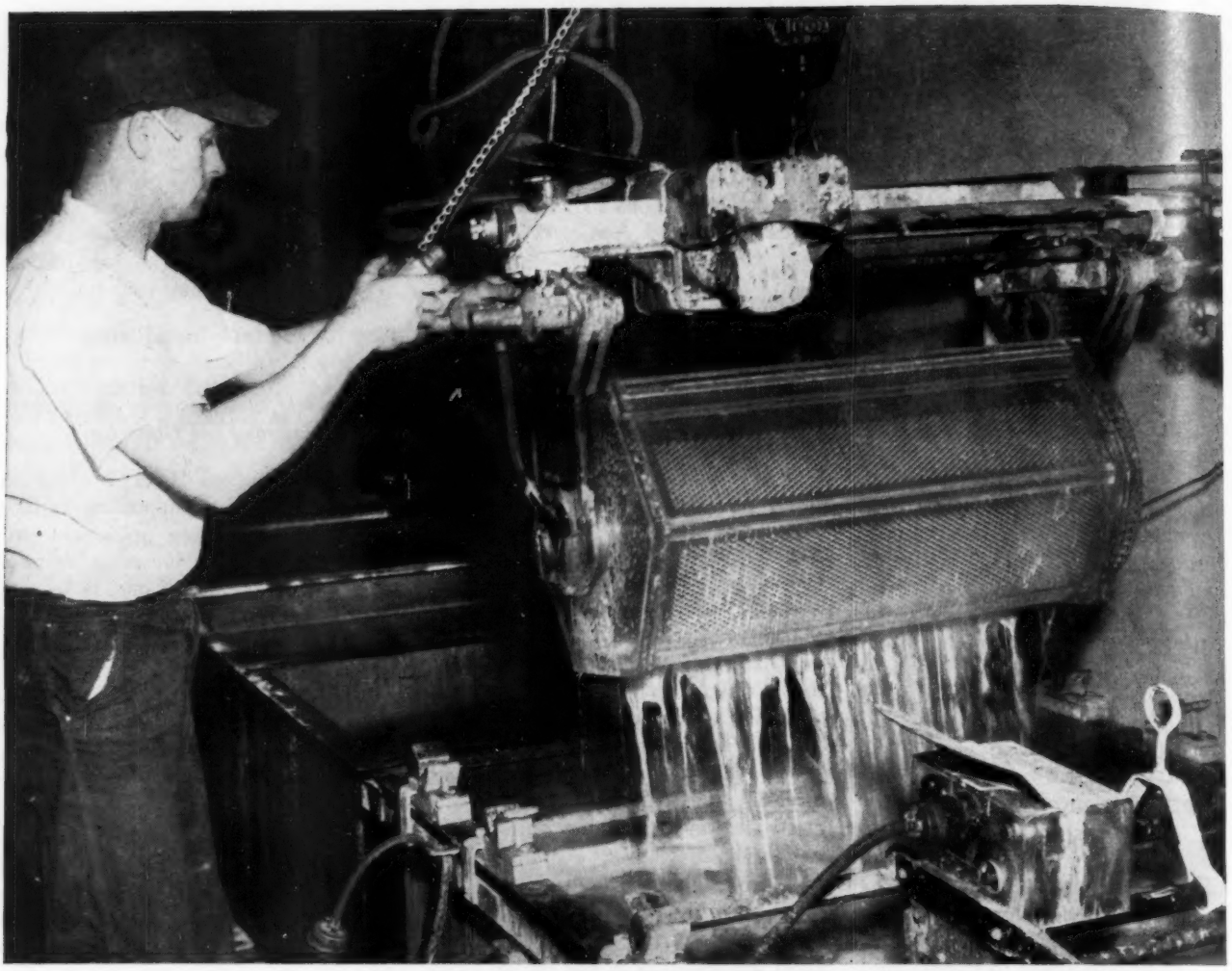
U. S. Patent 2,665,659. *Jan.* 12, 1954. *J. C. Ogle, Jr., assignor to Libbey-Owens-Ford Glass Co.*

In combination with a vacuum chamber having a supporting surface and a housing fitting upon said surface, said chamber including thermal evaporating means, of means located within the chamber and carried by the supporting surface thereof for removably supporting a plurality of article-carrying portable racks in predetermined spaced relationship within the chamber, said rack supporting means comprising rotatable socketed support means for releasably receiving and supporting one end portion of said portable racks, said rack supporting means also including rotatively mounted support means engageable with the other end portion of the portable racks for supporting the same for rotative movement within the chamber, said rotatively mounted support means being positioned in alignment respectively with the rotatable socketed support means, and means associated with said rotatively mounted support means for causing rotative movement thereof.

Motor-Driven Polisher Having Upper and Lower Casing Sections

U. S. Patent 2,665,439. *Jan.* 12, 1954. *P. J. More, assignor to Birtman Electric Co.*

A motor-driven polisher comprising a substantially integral upper casing section, a motor fixed to this upper section, a motor driven rotatable polisher member fixed to the upper casing section and bearing the full weight of the polisher, a handle rigidly attached to the upper casing section so that the handle, upper casing section and polisher member form a rigid unit, and a lower casing section removably attached to the upper casing section and enclosing the motor and a part of the polisher member for exposure of these



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NEWS OF PENNSALT PRODUCTS

elements on removal of the lower casing section.

Printed Circuits

U. S. Patent 2,666,008. *Jan.* 12, 1954. *K. Enslein and F. J. Haskins, assignors to Stromberg Carlson Co.*

The method of producing a conductive pattern of predetermined configuration on an insulating base member which comprises the steps of, depositing a layer of photosensitive fluorocarbon material on a highly polished stainless steel master base plate, exposing said photosensitive material to actinic radiations in a pattern corresponding to the negative of the eventual conductive pattern, developing said photosensitive material to provide a stencil of fluorocarbon on said master base plate, electro-depositing a layer of conductive material onto the areas of said master plate unmasked by said stencil, coating a surface of said master plate and an insulating base member with an adhesive, pressing said adhesive coated surfaces together, and separating said base member from said master base plate with said conductive layer of said predetermined pattern adhering to said base member.

Anodizing Aluminum

U. S. Patent 2,666,023. *Jan.* 12, 1954. *O. Schaaber, assignor to Siegfried Junghans.*

A process for the production of an oxidic coating upon an aluminum base metal which comprises immersing said aluminum base metal in a substantially water-free fused salt bath essentially consisting of at least one alkali metal nitrate and at least one alkali metal nitrite and supplying an anodizing current to said immersed aluminum base metal which anodizing current periodically varies from a voltage between –2.0 volts and 0 volt to a positive anodizing voltage up to 50 volts, the fused salt bath being maintained at a temperature between 140°C. and the melting point of the aluminum base metal during the treatment with the anodizing current.

Rust Inhibiting Composition

U. S. Patent 2,665,995. *Jan.* 12, 1954. *J. W. Bishop, assignor to Tide Water Associated Oil Co.*

A composition, adapted for use as a rust inhibiting coating for metals, comprising a substantially non-corrosive vehicle in major amount based on the weight of said composition, and a small amount, sufficient to impart rust-inhibiting characteristics to said composition, of a hydrocarbon acid phosphate salt of an alkylol-containing amine having an alkylol group esterified with a hydrocarbon sulfonic acid.

Chromium Plating Anode

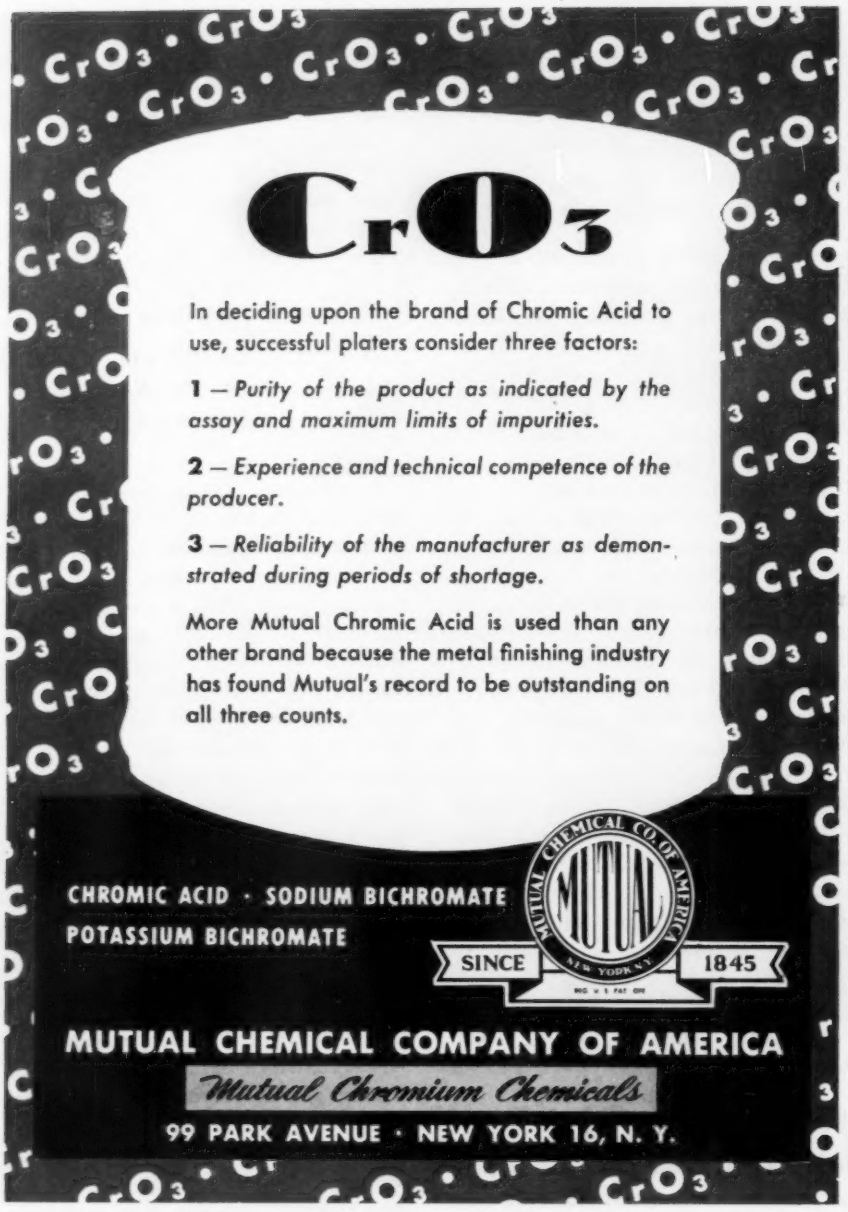
U. S. Patent 2,666,029. *Jan.* 12, 1954. *L. G. De Quasie and R. E. Kochs, assignors to Rochester Lead Works, Inc.*

A chromium plating anode comprising a one-piece body and a generally U-shaped hook portion containing at least a major proportion of lead, the hook portion having a groove extending longitudinally of its inner face coextensive with and arranged centrally between the side edges of the hook portion, and a copper contact rod located in said groove, said contact rod being coextensive endwise with the hook portion and having approximately one-half its cross-section embedded and secured throughout its length in said groove and approximately one-half its cross-section forming a continuous exposed surface coextensive with the hook portion and projecting laterally beyond the adjacent surfaces of the hook portion, said exposed surface of the copper contact rod having a tapering cross-sectional form affording a surface of limited area for contacting a conducting bar and said copper contact rod imparting increased stiffness and conductivity to said hook portion.

Belt Polishing Holloware

U. S. Patent 2,666,280. *Jan.* 19, 1954. *R. G. Riedesel, T. J. Miller and L. A. Martin, assignors to Minnesota Mining & Mfg. Co.*

In a machine for abrading the interior surfaces of hollow ware, a work holding chuck, means for rotating the chuck, means for effecting reciprocal axial movement of the chuck; a first abrasive belt assembly comprising rotatably mounted pulleys for supporting an endless abrasive belt, one of the pulleys being positioned adjacent the face of the chuck to serve as a contact wheel to apply the belt to the slide surface of the work, means for mounting the contact wheel for movement in a plane determined by the chuck's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axis, and means for rotating one of the pulleys to drive the belt; and a second abrasive belt assembly comprising rotatably mounted pulleys for supporting an endless abrasive belt, one of the pulleys being positioned adjacent the face of the chuck to serve as a contact roll to apply the belt to the bottom surface of the work, and means for rotating one of the pulleys to drive the belt.

Descaling Sheet Metal

U. S. Patent 2,666,282. *Jan.* 19, 1954. *R. O. Peterson, assignor to The Osborn Mfg. Co.*

In a method of removing scale from a metal sheet, the steps which comprise flexing the sheet, brushing the convex face of the latter, and simultaneously supplying to the face thus being brushed an abrasive consisting substantially entirely of previously removed scale particles.

Bright Silver Bath

U. S. Patent 2,666,738. *Jan.* 19, 1954. *O. Kardos, assignor to Hanson-Van Winkle-Munning Co.*

A process for producing bright silver electrodeposits, which comprises electrodepositing silver from an aqueous cyanide silver plating bath containing 0.02 to 0.04 oz./gal. (0.15 to 0.30 g./liter) of the solid, water- and acid insoluble but alkali soluble reaction product of a ketone of the formula RCH_2COCH_3 where R comprises a substituent selected from the group consisting of hydrogen, alkyl, acetonyl (CH_3COCH_2—) and alkali metal carboxymethyl (—CH_2COONa, — CH_2COOK), with carbon disulfide and alkali hydroxide, this reaction product having been precipitated by addition of a strong mineral acid and freed from alkali sulfide and hydrogen sulfide.

Corrosion Preventing Agent

U .S. Patent 2,666,745. *Jan.* 19, 1954. *L. V. Mullen, Jr. and J. M. Boyle, assignors to Standard Oil Development Co.*

A hydrocarbon oil containing a corrosion inhibiting amount of a product obtained by reacting together substantially equimolar amounts of a dialiphatic hydrocarbon substituted cyanamide, containing 1 to 30 carbon atoms in each aliphatic group and containing at least one unsaturated grouping in at least one of such aliphatic groups, and an amine selected from the group consisting of primary and secondary aliphatic and cycloaliphatic amines containing 1 to 30 carbon atoms at a temperature of 100-250°C., and sulfurizing such reaction product by reacting the same with elemental sulfur until 10 to 30% of sulfur is combined therewith.

Automatic Dryer

U. S. Patent 2,666,995. *Jan.* 26, 1954. *A. H. Kirkpatric, assignor to Frederic B. Stevens, Inc.*

A dryer for work pieces comprising a casing, means for conducting a stream of heated air through said casing, inclined supports at each side of said casing extending longitudinally of the casing, and a plurality of trays mounted in echelon arrangement on said supports, said trays having a charging end and a discharging end, said trays being arranged on said supports with the discharging end of one tray overlying the charging end of the next adjacent tray, means for vibrating said trays such that work pieces deposited on the uppermost tray gradually travel to the lowermost tray, said trays being inclined downwardly in the direction of their discharge ends, the trays adjacent the upper end of said supports being inclined to a lesser extent than the trays adjacent the lower ends of said supports, said last mentioned trays being positioned in said stream of heated air and said trays adjacent the upper end of said

supports being disposed out of the direct path of travel of said heated stream of air.

Wet Blasting Apparatus

U. S. Patent 2,667,014. *Jan.* 26, 1954. *W. I. Gladfelter and C. P. Croft.*

In a wet-blasting apparatus, a blasting machine having impelling structure connected to project against work articles a stream of blastant particles mixed with liquid to work the surfaces of the articles and remove debris there-from, collecting means for collecting the projected blastant particles and liquid together with the debris from the work articles, separating means for separating large sized particles of the said debris from the mixture of blastant particles and liquid, a classifying apparatus connected to receive the mixture of blastant particles and liquid from said separator and adapted to classify said mixture and separate a thick slurry containing the large sized particles of said blastant material from said mixture, a clarifying apparatus connected with said classifier to receive the remaining mixture therefrom and including structure for clarifying the liquid portion of the mixture, and recycling means connected to return the clarified liquid to the blasting machine for additional blasting.

Washing Sand Abrasives

U. S. Patent 2,667,015. *Jan.* 26, 1954. *R. R. Berg, assignor to Mariblast Corp.*

Apparatus for feeding a fluid abrading mixture to a discharge conduit, said apparatus comprising a tank having a rounded bottom portion, a perforated plate within said tank and disposed above said bottom portion, said plate adapted to hold an abrasive thereon, said tank being closed to atmospheric pressure, an inlet in said bottom portion for admitting a fluid under pressure, an outlet pipe extending from said plate through said bottom portion to a discharge conduit, an over-flow pipe disposed above said plate and joining said discharge conduit.

Dust Collector Hood Construction

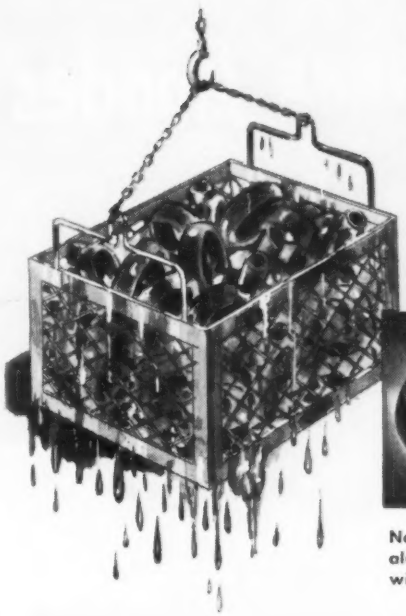
U. S. Patent 2,667,017. *Jan.* 26, 1954. *R. Jaron.*

A dust collector hood having a base, sides, and a back plate, said sides having recessed front edges for receiving the shaft of a polishing wheel, a compartment at the lower rear end of the hood having a front transverse partition extending between the sides and upwardly from the base and to the back plate, said compartment having a suction opening in the lower portion thereof and said partition having an opening at a height for receiving polishing dust from the lower portion of the polishing wheel, and a screen extending across said partition opening.

Filter-Agitator

U. S. Patent 2,667,270. *Jan.* 26, 1954. *S. S. Cady and W. E. Sabatka.*

In an apparatus for filtering plating solutions, a hollow exterior element, a hollow interior element within and in spaced relation to said hollow exterior element and providing therewith an annular chamber, a wall extending between portions of said hollow exterior and interior elements and closing an upper end of said annular chamber, a base member closing a lower end of said annular chamber and lower ends of said hollow exterior and interior elements, a pump cylinder within a lower portion of said hollow interior element, an inlet to said pump cylinder, an outlet from the pump cylinder to said annular chamber, a pump plunger in said pump cylinder, means for actuating said pump plunger, a hollow filtering element in said annular chamber in spaced relation to said hollow exterior and interior elements and having its opposite ends contiguous with said wall and said base member, re-



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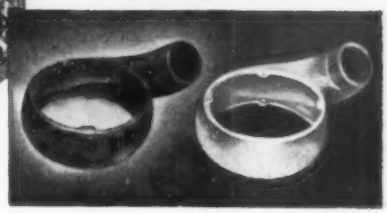

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TIN	Available in any length in our corrugated Wagner Brothers' Iso-Cast form with locked-in steel contact hook, in standard balls and Iso-Cast Ovals. We also produce Tin-Lead (15% tin, 85% lead) and Tin-Zinc (80% tin, 20% zinc), same forms.
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spectively, an outlet from said hollow exterior element, a hollow interior member snugly fitted into and vertically slidable in an upper portion of said hollow exterior element, and a float member rigid with an interior lower portion of said hollow interior member.

Prevention of Rust

U. S. Patent 2,667,408. *Jan.* 26, 1954. *M. P. Kleinholz, assignor to Sinclair Refining Co.*

A light petroleum distillate to which a rust inhibiting property has been imparted by the incorporation of approximately .5 to 50 pounds per 1,000 barrels of distillate of an oxidized microcrystalline wax having from 34 to 55 carbon atoms per molecule which consists essentially of carboxy acids having a saponification number in excess of 100 and not exceeding 260, having an acid number within the range of about 70 to 160 and having an iodine number less than about 20.

Plating Copper on Steel Wire

U. S. Patent 2,667,453. *Jan.* 26, 1954. *G. E. Murray, assignor to Western Electric Co.*

The method of electroplating copper on steel wires, which comprises continuously advancing a steel wire as a cathode seriatim through an alkaline cyanide flash coating bath containing copper dissolved therein at a concentration within the range of from about 1.5 to about 3.0 ounces per gallon, a second alkaline cyanide bath containing copper dissolved therein at a concentration within the range of from about 4.5 to about 7.0 ounces per gallon, and an acid plating bath containing a still higher concentration of copper dissolved therein, maintaining in the cyanide flash bath a cathode current density within the range of from about 20 to about 75 amperes per square foot for a period of time sufficient to deposit a very thin and very fine-grained flash coating of copper which sets a size pattern that causes subsequent deposits on the wire to be similarly fine-grained, maintaining in the second cyanide bath a cathode current density substantially higher than the current density in the flash coating bath to deposit a fine-grained copper coating substantially thicker than the flash coating of copper, and maintaining in the acid plating bath a still higher cathode current density to form a thick copper deposit which

increases materially the electrical conductivity of the resulting composite wire.

Continuous Pickling and Acid Regeneration

U. S. Patent 2,668,130. *Feb.* 2, 1954. *E. D. Martin, assignor to Koppers Co., Inc.*

A continuous cyclic process for the pickling of iron and steel and for regenerating the used pickle liquor which comprises conducting the pickling operation with a pickle liquor having an acid concentration maintained within the range of from about 14% to about 22% by volume of sulfuric acid and maintaining the liquor at a temperature of from about 180°F. to about 220°F. whereby to permit rapid and uniform pickling at a relatively high ferrous sulfate concentration; continuously withdrawing used pickle liquor from the pickling step for regeneration and continuously concentrating the used liquor by evaporation; continuously adding fresh sulfuric acid to the pickle liquor being regenerated while at the same time maintaining the concentrated liquor at a temperature of from about 180°F. to about 220°F. whereby to effect rapid crystallization and precipitation of ferrous sulfate solely in the monohydrate form as a result of the combined effects of said temperature and increased acidity in lowering the solubility of ferrous sulfate monohydrate; continuously separating crystallized and precipitated ferrous sulfate monohydrate and thus obtaining a resultant concentrated liquor having a sulfuric acid concentration above said range; continuously diluting said resultant concentrated liquor with sufficient water to obtain a regenerated pickle liquor having an acid concentration within said range; maintaining the pickle liquor at all times throughout the aforementioned regeneration steps at a temperature of from about 180°F. to about 220°F. whereby to provide a regenerated pickle liquor adapted for continuous recirculation to the pickling step without reheating; and continuously recirculating the regenerated pickle liquor directly to the pickling step whereby to provide a continuous pickling and regeneration system characterized by high heat economy and low heat input requirements as a result of the maintenance of substantially the same operating temperature during both pickling and regeneration.

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ABSTRACTS

Modern Chemical Corrosion Resistant Coatings

H. Keller: *Industrie Anzeiger.* Vol. 75, No. 86, pp. 10-12.

Modern developments at the cleaning pretreatment stage have been in the direction of the application of emulsion cleaners. Where resinified grease is present, certainty cannot be attached to the effectiveness of an alkaline degreasing. At the pickling and passivation stages, processes are now available which have been developed on a phosphoric acid basis and which are arranged to work in line-flow operation. Subsequent phosphating is conducted (a) to provide phosphate coating protection in conjunction with grease, oils, waxes and the applied phosphate coating has a thickness of 10 to 20 microns. (b) The production of phosphate coatings of 1 to 3 microns in thickness to serve as a basis for subsequent lacquering; the addition of neutralization accelerators reduces the phosphating time to some minutes and the phosphate coating thickness to 1 to 3 microns. The phosphating temperature is also lowered.

Determination of the Protective Value of Pickling Inhibitors

K. Pfanhaeuser: *Beiztechnik.* Vol. 3, No. 1, p. 10.

The protective value of pickling inhibitors is determined by the loss in weight of a steel sheet in g./sq. m. in acid with and without the pickling inhibitor addition. Varying amounts of inhibitor are added for the test. From the values obtained by experiment, the protective value of the inhibitor is obtained by the following formula:

$$\text{Protective value in } \% = \frac{\text{Loss in the Protected acid} \times 100}{\text{Loss in the Unprotected Acid}}$$

In order to be able to compare various pickling inhibitors with one another, the test conditions (temperature, acid concentration, and the amount of pickling inhibitor) must be the same.

The test procedure is conducted as follows. Sheets of the same type of steel are freed from any adherent scale with warm acid solution and

finally washed with alcohol and weighed. The acid with the specified pickling inhibitor is placed in a beaker and the control test is conducted without the pickling inhibitor. The acid is brought to the average temperature employed in operation and the steel sheet immersed in this. After a quarter of an hour, half an hour and 1 hour pickling times corresponding to the average pickling time in operation, the sheet is removed, rinsed with warm flowing water and neutralized in a 2% caustic soda solution. The test sheets are dried with filter paper and weighed.

During the test, visual observations are made regarding the extent of the hydrogen generation, solubility, of the inhibitor, deposits on the material being pickled.

The Tetrachromate Chrome Plating Bath

H. W. Dettner: *Metalloberflaeche.* Vol. 5, No. 10, p. B. 151.

The tetrachromate bath is characterized among other things by being a cold chrome plating bath. Particularly when nickel was scarce and restricted for general purposes, this bath assumed considerable commercial importance although it did not absolutely fulfill some exaggerated claims that had been made for it. The chief difference of this bath as compared with the normal chrome plating bath consists in the addition of caustic soda to the bath, by which sodium tetrachromate is formed. According to the patent specification (German Patent DRP 608757; French Patent 754, 299) the ratio of Na_2O : CrO_3 should lie between 1:2 up to 1:6. In practice the following bath compositions have been evolved:

	(1)	(2)	
CrO_3	400	300	g./l.
NaOH	58	60	"
H_2SO_4	0.75	0.6	"

The bath is, accordingly, not so strongly acid as normal chrome baths. It can, therefore, be used with advantage for the chromium plating of zinc. The The voltage and fissuring are lower than is normally the case with chrome plating. On the other hand it is stated that not too much should be expected as regards the corrosion resistance. Thus, with this plating, unless the standard minimum thickness of 20 to 30 microns is applied, it is stated that corrosion resistant coatings will not be obtained. Copper-chromium coatings

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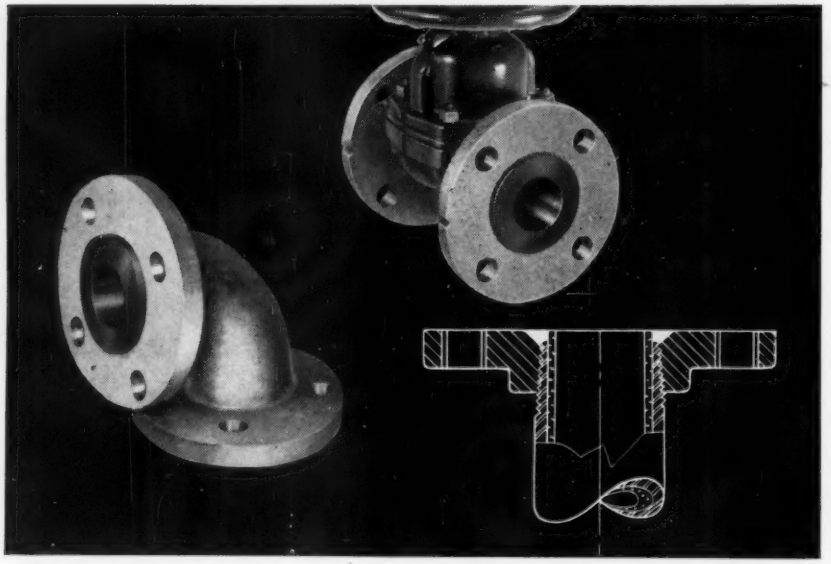

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will not be so corrosion resistant as those with a nickel undercoat.

A special advantage of the tetrachromate chrome bath is the possibility of applying higher current densities. The holder of the tetrachromate patent claims that up to 1,000 amps/sq. dm. can be attained; in practice the tetrachromate bath is generally worked at around 20 to 80 amp./sq. dm. A further factor is that with this bath the current efficiency is considerably higher than with the normal chrome plating baths (30-37%). Accordingly, one can plate more rapidly with this bath so that at a current density of 50 amp./sq. dm. and 30% current efficiency a coating thickness of about 70 microns can be obtained in an hour. The bath temperature must be maintained between 16 and 22°C. and the bath must be cooled. If the bath temperature rises above 30°C. the sodium tetrachromate formed begins to decompose and, at 40°C., it is completely decomposed. The chrome plate most usually comes matt from this bath but can easily be polished.

Adhesion of Nickel-Chromium Plated Coatings

A. Krusensjern: *Metalloberflaeche.* Vol. 5, No. 10, pp. B 153 B 154.

A fundamental and thorough degreasing plays a decisive role in the adhesion of nickel-chromium plated coatings The author studied the factors involved regarding the influence of the cleaning as well as the time factor between the buffing and polishing on the one hand and the degreasing on the other hand on the adhesion of the plated coatings, by way of a comprehensive series of tests. The test pieces used were spherical parts of two semi-circular dishes 250 mm. diameter. It was considered that this shape was particularly suitable for the test as adhesion failure was easily recognized and the brilliantly polished semi-circular shaped brass surface tends to stressing in the deposited coating and would, accordingly, promote flaking at positions of unsatisfactory cleaning. Twenty of these semi-circular dishes were carefully cleaned with solvent naphtha after buffing and polishing, then cathodically degreased in a commercial electrolytic degreasing bath, rinsed, copper plated in an alkaline bath, rinsed, nickel plated in a bright nickel bath, and finally chrome plated. After chrome plating, the parts under

control were sharply polished and heated for an hour at 150°C. without any peeling becoming perceptible with careful scrutiny. Also, after a four weeks' storage in a damp atmosphere, no changes could be seen.

Twenty further semi-circular dishes were then only superficially cleaned after buffing and polishing as would be the case under commercial conditions with unskilled labor. They were then immediately placed in the cathodic degreasing bath. The parts were then further handled as before. In this case only 8 of the test pieces could be regarded as satisfactory under the control conditions. On two parts, strong pitting formation was seen. In the region where the two parts were soldered together, an efflorescence was seen; some of this could only be seen after four weeks storage.

In a final test, 20 more of these semi-circular dishes were similarly only superficially cleaned and finally allowed to stand for 14 days. Only then were the parts further processed. The test pieces partly showed a clear marked discoloration on the surface. With four of the parts, the nickel coating had already flaked off. With the remaining parts blistering occurred after the chrome plating and faults at the soldered joint. Only five parts could be considered as satisfactory and four parts showed pitting formation. On one of the parts with pitting formation, finger prints could still be clearly seen. A test run on a large brass letter which had only been cleaned at the upper part after polishing showed at the lower, uncleaned part, clusters of pitting marks and in places again, finger prints could be seen.

Health Hazards with Chrome Plating and Their Prevention

W. Kohl: *Metalloberflaeche*. Vol. 5, No. 10, pp. B 154-B 155.

Special attention needs to be devoted to chrome plating baths; as is known, chromic acid is a strong, aggressive agent with a deep but relatively slow working action. The chromic acid has no chronic effect on intact, healthy skin but skin at fissures is less resistant and the chromic acid which rests here has a longer time to act and at such damaged cracks and weakened places in the skin, there occurs an intensive skin-damaging, penetrative effect. Characteristic sharp-edged sores appear at these places

Industrial

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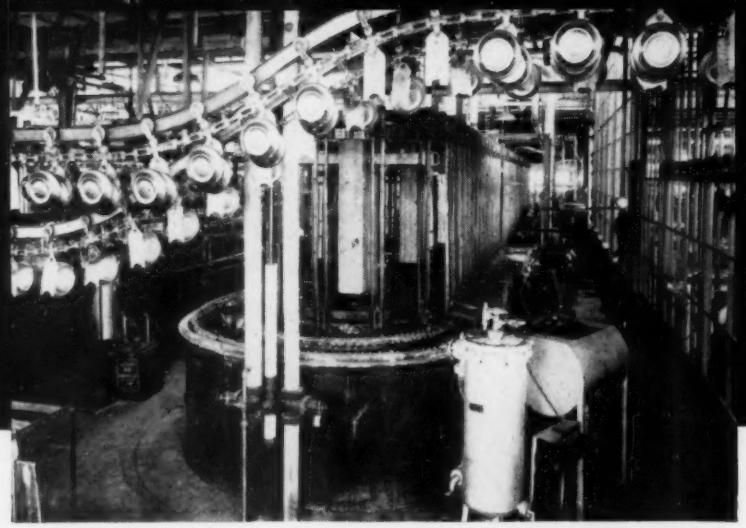

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which are about 3-10 mm. in diameter. As a rule, these sores tend to heal very badly and several weeks at least are required for healing. In addition to this, many persons in the course of time develop a marked hyper-sensitivity to these substances when in frequent contact with chromic acid or chrome salt solutions. The results of this hyper-sensitivity can be extremely obstinate.

Characteristic disorders caused by chromic acid also occur at the mucous skin lining of the nose. With insufficient protective and venting arrangements the chromic acid mist formed by gas evolution in the chrome bath will penetrate into the working atmosphere around the bath and be breathed in by the workers. The mucous skin lining is very strongly attacked and first a strong, unpleasant discharge is caused. As a result of the separation of minute chromic acid crystals there is then caused inflammation and the formation of sores and this can even finally lead to a perforation of the nasal septum. In addition to this, the mucous skin of the upper air passages can also be co-affected by the chromic-acid containing vapors or dust. At times there then develops chronic asthmatical and bronchial catarrh which can appreciably affect the well-being of the workers and the factory output. The catarrh is often associated with a dry and hacking cough which always results in only a small amount of mucous being ejected externally. Under bad working conditions general debility will be accompanied with the above symptoms, comprising dizziness, headaches, loss of appetite and loss of weight. The more severe types of lung diseases which are found with chrome ore processing and chromate production are not usually encountered in chrome plating works.

Finally, the eyes also can suffer damage by the effect of chromic acid. If chromic acid or chrome salts crystals penetrate into the eyes, sores will be formed and insoluble chromic oxide precipitated by photochemical action.

The obvious action to take is to prevent the chrome acid mist from entering the working atmosphere, by good venting, suction and mist precipitation units. Merely covering the chrome plating bath is in itself alone not sufficient. In this case an explosive gas mixture can form over the surface of the electrolyte by virtue of the

hydrogen generated by the bath action. The possibility exists that this can be ignited by way of sparking. For small baths, where the cost of expensive suction venting arrangement is not justified, covering the bath liquid with paraffin oil, crude petroleum or similar oils will afford security. In such cases, additionally, the working space round the bath must be high, bright and well ventilated. For each working person, 15 cubic meters of air space should be allowed. To avoid eczema and sores from direct contact with chromic acid solution, it is essential that the plating bath and equipment be so designed that the workers are never in actual contact with the bath. It is important that adequate handling equipment is provided, such as hoists, tongs, hooks or baskets capable of dealing with any weight of article being plated in the bath without need for manual handling.

Hard Chrome Plating of Aluminum

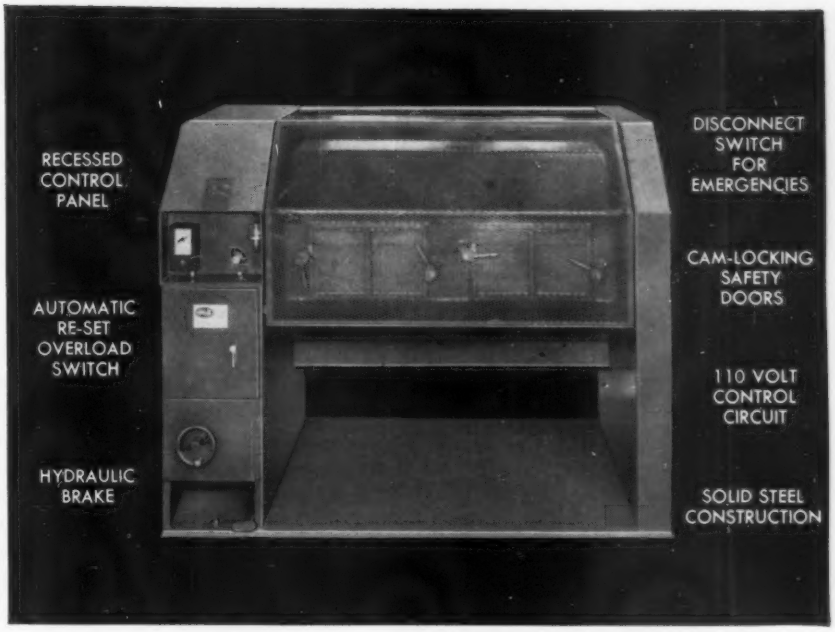
E. Meyer—Raessler: *Metall.* Vol. 6, pp. 504-506.

The hard chrome plating of aluminum has achieved considerable technical importance for producing surfaces on a light metal base which are resistant to wear and to heat; the process has come into extensive use since it was found how to plate an adherent chrome coating on aluminum. The author gives a brief survey of the most important properties of the aluminum, the alloys and the hard chrome; the different possibilities of the pretreatment of the aluminum for the hard chrome deposit. Consideration is then given to making the smooth, worked surface oil-retaining, and pores and crevices can be produced in the coating by the aid of chemical and electrochemical processes. Chrome plated aluminum cylinders are considered and it is found that these give the best results in internal combustion engine vehicle operation.

Surface Treatment by Tin-Nickel Alloy Plating

Metall. Vol. 6, p. 399.

By the application of a tin-nickel alloy with 65% tin and 35% nickel, it is possible to save nickel as compared with normal nickel plate. A coating of this alloy shows good corrosion resistance to various media and the corrosion resistance is better than either of the two component metals alone.



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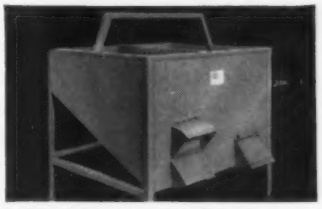
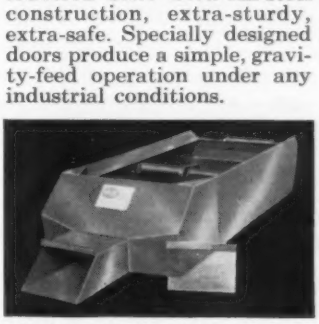


HONITE CHIP BIN. All-steel construction, extra-sturdy, extra-safe. Specially designed doors produce a simple, gravity-feed operation under any industrial conditions.



HONITE HOIST PAN. All-steel construction, available in two sizes. Especially designed for quicker, easier materials handling, it will stand up to long years of hard use.

MODERN, SAFE, simple to operate HONITE DV-5 and DV-3 Barrels (5 h.p. and 3 h.p.) are ruggedly constructed from the solid steel base up to guarantee a long service life. You save on maintenance costs because motors are housed in a splashproof case; electric switches are mounted in watertight compartments; wiring is factory installed and completely waterproof. These barrels are built to outlast and outperform any other model on the market today. For further information call your HONITE Field Engineer today, or send coupon below.

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3M COMPANY

Recent Developments

SPECIAL NOTICE TO OUR READERS

The claims made for products and processes in this section are strictly those of the manufacturer concerned and not the opinions of this publication. While our editors carefully screen all material submitted, it is impossible for us to investigate all claims made before our monthly publication date. This notice is printed in connection with a Recent Development item which appeared in our July issue and which we regret has caused some misunderstanding in the plating industry.

Non-Sludging Copper Anodes

The American Brass Co., Dept. MF, Waterbury 20, Conn.

A newly patented copper anode requires no bagging or diaphragms when used in acid copper plating solutions. The addition of controlled minute amounts of phosphorus and other elements to the new Anaconda Plus-4 copper anodes result in complete freedom from sludging so that heavy deposits can be built up without roughness and 10 to 15% more cathode deposit is available per pound of anode.

The new anodes are available in all the standard sizes and forms at no increase in cost over ordinary anodes.

36-In "Package" Vacuum Metallizer

F. J. Stokes Machine Co., Inc., Dept. MF, 5500 Tabor Road, Philadelphia 20, Pa.

A new and very compact "package" vacuum metallizer, designed to meet the needs of firms with moderate production requirements, such as jewelry manufacturers, custom plastics molders, custom metal finishing plants, and other manufacturers who wish to do their own finishing but have a relatively small volume of work, has just been introduced.

The new Model 428 metallizer has a chamber 36 in. in diameter and 60 in. long, giving it two-thirds the cubic capacity of the popular 48-in. Model 426. The 428 is a simplified unit, stripped of some of the more elaborate automatic features of the larger metallizers, and is intended to bring vacuum metallizing economically within the reach of firms whose present volume would not justify the larger units.

The new vacuum-coating unit has an integral vacuum pumping system, consisting of oil diffusion pump and rotary mechanical fore-pump, which will bring the chamber down to the metallizing pressure of 0.5 micron in about 10 minutes. A console-type control panel groups in one convenient place all push buttons, starters, vacuum gages, rheostats, etc.

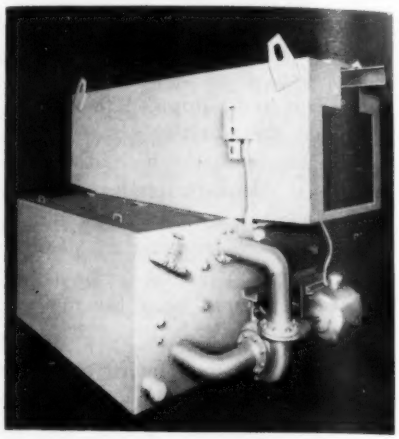
The work-holding rack of the new Model 428 will accommodate four standard rotating fixtures identical to those used in larger metallizers. These racks can therefore be retained and used in the larger units in the event that the customer's production requirements increase later on to the point where either a 48-in. or a 72-in. unit would be justified.

Spray Washer

Detrex Corporation, Dept. MF, Detroit 32, Mich.

The new Series 30, standard unit, monorail-type spray washer is the first washer that can be used as a single unit or combined on the premises into a multi-stage washer to suit the needs of the user without expensive alterations or assembly problems. Units can be assembled on the premises, either by bolting or welding, and offer a wide variety of combinations.

A range of sizes from a spray length of 4′ up through 10′ in two-foot steps is available. Each washer unit, set up for gasketing, will accommodate work up to 30 inches wide—with the additional convenience of removable baffles to reduce width where operating economy calls for a narrower opening. Seven different heights are available in



the washer openings: from 24″ upward in 6″ steps to the maximum height of 60″. The user also can vary the silhouette with synthetic rubber curtains which protect against overspray and aeration.

The tanks themselves are constructed of 3/16 steel plate with reinforced bottoms and hold 600 to 1,000 gallons of solution.

Spray nozzles are mounted on swingells and are adjustable for most effective contour spraying of any surface. Nozzle orifices are large and are protected with screening one-half the size of the nozzle opening, thereby reducing nozzle clean-up to a minimum. Access to the spray bank is through a large door, gasket sealed, and equipped with toggle clamps—no nuts and bolts to remove.

Pumps and motors are located away from the aisle space. The pump has double ball bearings, open ball bearing motor and starter and is rated to handle liquids at elevated temperatures of 160 to 180 degrees Fahrenheit. Piping from the pump to the spray headers has flanged connections to permit easy removal of pump or header and has only one 90-degree bend, insuring maximum pressure at the heads. Protection screens ahead of the pump are easily accessible.

Either steam or gas may be used for heating the solution. The steam units are designed to operate on

pressures from 50 to 125 pounds and ample radiation is assured by the use of multiple pass steam coils. The units designed for natural or manufactured gas operate on pressures from two to sixteen ounces and are equipped with immersion heating tubes complete with aspirator-mixer, pressure burner and all necessary equipment for absolutely safe operation.

Revolutionary design has eliminated most of the work of clean-up and maintenance. Tank skirts extend flush to the floor with no ledges or platforms to accumulate dirt. Ninety per cent of the tank bottom of steam machines can be reached with a hoe and gas immersion coils are also spaced to provide ease of scraping and hoeing. A scum overflow trough is standard equipment. Exit, entrance and drain zone sizes are so designed to eliminate overspray.

The new spray washer is designed for use of phosphate coatings of the iron-phosphate type. Washers for zinc-iron-phosphate use will be available shortly.

Flexible Lining Material

Kaykor Industries, Inc., Dept. MF, 4400 Broad St., Yardville, N. J.

A new, easily installed, flexible lining material combining excellent chemical, physical, and electrical characteristics, was announced recently.

Designated Vyflex L-10, the new thermoplastic lining based on polyvinyl chloride resins is suitable for numerous industrial lining needs. It protects such varied equipment as tanks, fume ducts, tank cars and trucks, and the highly complex equipment used for mixing, storing, washing, transporting, etc. of corrosives.

The lining resists corrosive action from an extremely broad group of industrial chemicals, from common acids, alkalis, salts, plating solutions, and organic compounds, to oxidizing acids like nitric, chromic, and phosphoric, and highly concentrated strong alkalis . . . and at operating temperatures up to about 160°F.

Being inherently elastic, thermal expansion and contraction will not crack it, and the damaging effects of mechanical abuse are minimized. Good insulating qualities minimize current loss in electrolytic reactions. And the inherently smooth, highly polished surface simplifies cleaning, speeds so-

now you can get this brilliant finish directly on zinc die castings!

No electroplating--no mechanical finishing!

PART AS CAST

TREATED WITH NEW IRIDITE

NEW

IRIDITE® (Cast-Zinc-Brite)

brightens zinc die castings by chemical polishing, protects against corrosion

NOW, FOR THE FIRST TIME you can get a brilliant, decorative finish directly on zinc die-cast parts . . . without mechanical finishing, without electroplating! The luster is provided by the *chemical polishing* action of new Iridite (Cast-Zinc-Brite) solution. Even surface blemishes, such as cold shuts, are brightened by this new process. No electrolysis. No special equipment. No specially trained personnel. Just a simple chemical dip for a few seconds and the job is done. And, this new Iridite has been *tested and proved* in production.

CORROSION RESISTANCE, TOO! New Iridite (Cast-Zinc-Brite) provides exceptional corrosion resistance for bright-type chromate finishes . . . also guards against blueing or darkening by eliminating zinc plate formerly required in bright chromate finishing of zinc die castings.

AS A BASE FOR ELECTROPLATING—Lower mechanical finishing costs are possible where plated finishes are *required* since the brightness provided by this new Iridite may be sufficient.

LET US SHOW YOU what Iridite (Cast-Zinc-Brite) can do for you. Send us at least a half-dozen typical zinc die-cast parts for FREE PROCESSING for your own tests and evaluation. Or, for immediate information, call in your Iridite Field Engineer. He's listed under "Plating Supplies" in your classified 'phone book. *IMPORTANT: when you give us samples for test processing, please be sure to identify the alloy used.*

Iridite is approved under government specifications

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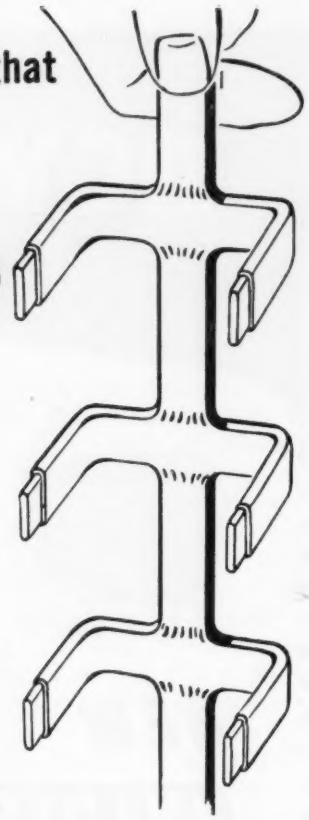
Manufacturers of Iridite Finishes for Corrosion Protection and Paint Systems on Non-Ferrous Metals; ARP Plating Chemicals

Be sure of rack protection that

STICKS TIGHT



through all cycles

...use COATING 218X

USERS of Unichrome Coating 218X know that in Unichrome Primer 219PX they're getting the outstanding *single coat primer* developed. It not only saves time and work, but also assures maximum benefits from the remarkable properties of Coating 218X.

Anchored to this primer, Coating 218X takes hard use – even abuse. It defies all plating and cleaning cycles without blistering, or lifting at contacts. It won't crack, chip or tear. It even resists vapor degreasing cycles.

Remember, Coating 218X is produced by United Chromium . . . the company that has: (1) Developed plating processes; (2) Given service on plating problems; (3) Pioneered highly corrosion-resistant plastisol coatings . . . and therefore knows what a rack coating needs for maximum plating service.

UNICHROME Trade Mark COATINGS for METALS

Products of UNITED CHROMIUM, INCORPORATED

100 East 42nd St., New York 17, N.Y. • Detroit 20, Mich. • Waterbury 20, Conn. • Chicago 4, Ill.
Los Angeles 13, Calif. • In Canada: United Chromium Limited, Toronto 1, Ont.

lution flow, and provides superior abrasion resistance.

Use of the new material, which is available in black and white, eliminates much of the complexity formerly associated with the lining operation. It permits lining as easily in the field as in the shop, in less time. Whether applied to steel, wood, or concrete no curing is required.

Aluminum Etchant

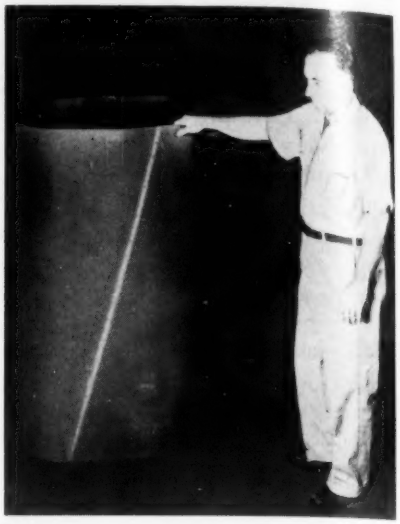
Oakite Products, Inc., Dept. MF, 118 Rector St., New York 6, N. Y.

The recent addition to its line of industrial cleaning and allied materials of Composition No. 160, a granular alkaline-type aluminum etchant has been announced by the above company. It is reported to provide a rapid, uniform controlled etch on aluminum, and eliminate the former troublesome problem of hard sludge build-up on equipment surfaces.

Among the advantages claimed for this new material by the manufacturers are the following: (1) it is readily soluble in water to form working solutions having exceptionally long life; (2) it offers good rinsability in either cold or hot water; (3) upkeep requirements are low; (4) it gives off no troublesome fumes; (5) it does not form hard sludge on tank surfaces and heating coils — the sludge created during etching operations with this material is no more than a soft slurry, which may be readily flushed down the drain when the solution is discarded.

Abrasive Belt

Michigan Abrasive Co., Dept. MF, 11900 E. 8-Mile Road, Detroit 34, Mich.



Under actual field tests on various types of stainless steel, the new 50-inch wide resin waterproof cloth belts are claimed to have removed stock four times faster than by all other previous methods. They are safer due to two facts, firstly, the water-coolant method eliminates the fire hazards caused from sparks and, secondly, it eliminates the oily conditions caused by the use of petroleum-base coolants. These belts are stated to be more effective because the cutting grits bite more sharply and remove far greater amounts of stock than surfaces covered with oil from petroleum-base coolants. The new 50-inch-wide Resinwet cloth belts are now in high volume production.

Side Arm Type Automatic Plater

Frederic B. Stevens, Inc., Dept. MF, 1800 18th St., Detroit 16, Mich.

A new full automatic side arm type machine, for electroplating or allied processing finishes, supplements the existing company line of automatic rack and barrel type plating and/or processing equipment.

The Stevadoer incorporates modern design features which will meet today's requirements of low head room—high lift. It also offers delayed set down methods and the new projected safety requirements. The transfer method is entirely revolutionary and provides for automatic load and unload.

In designing the new machine, the manufacturer engineered new units for automatic load and unloading modern standard shop conveyors in connection

with either single or double row type processing machines. These automatic load and unloading machines are in line with the automation concept as it relates to cost reduction by eliminating material handling costs.

Racks can be conveyed to the load station of the plant's automatic rack-type processing equipment, loaded, processed, unloaded and transferred to the next manufacturing stage automatically.

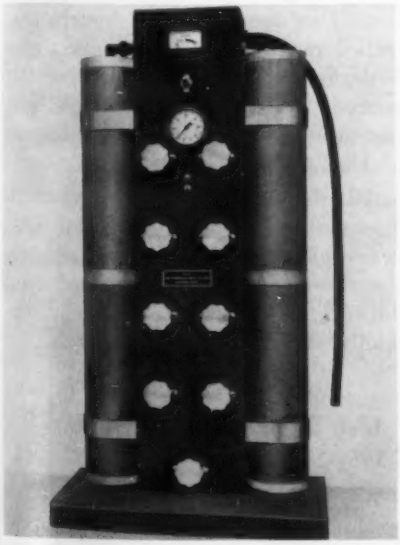
Regenerative Bench Model Demineralizer

Penfield Mfg. Co., Inc., Dept. MF, 19 High School Ave., Meriden, Conn.

Representing the most advanced design in the modern art of ion exchange, a new bench model demineralizer comprises a completely packaged unit that requires only 15″ x 8″ of counter space. The new Model L-20 demineralizer is a regenerative type and will supply up to 20 gph of super high purity water at a chemical cost of only pennies for each 100 gallons produced.

For instance, in New York City, based on the unit's exchange capacity of 2200 grains between regenerations and a 50,000-ohms end point, the chemical costs for producing 60 gallons demineralized water are three cents.

The unique dual action design of the demineralizer enables two columns to do the work of four. Raw water first is filtered through a stainless steel screen and then is given complete demineralizations through two columns, each of which contains both a cation resin bed and an anion resin bed, to produce a dually deionized effluent of less than 1 ppm.



Regeneration, including rinse-off, is accomplished in less than 45 minutes by simply turning a few valves conveniently located on the face of the control panel and clearly marked for trouble-free operation.

The unit's special flow control system automatically keeps incoming flow constant at not over 20 gph. Thus ion exchange action of top efficiency always is assured.

Featuring non-corrosive construction throughout and equipped with a conductivity meter for continuous visual indication of the purity of the effluent, the unit is shipped completely assembled, including regenerated resin charges, ready for immediate use on connection with water supply.

FORMAX

the Perfect Combination

FROM START TO FINISH

ZIPPO CLOTH BUFFS

These famous long-wearing buffs run cool under all buffing conditions. High count bias-cut cloth is assembled on ventilated steel centers. Each section is perfectly balanced and faced—requires no raking.

BUFFING COMPOUNDS

Formax produces a complete line of buffing compounds in bar, tube and liquid form.

Our extensive manufacturing, laboratory and testing facilities are at your disposal.

ZIPPO SISAL BUFFS

You have a pleasant surprise coming if you haven't tried the new Zippo bias-type sisal buff. It was specifically developed for steel buffing—to blend polishing grit lines—to cut down stainless steel—and bring up a bright lustre.

Other Formax products include the well-known C-20 Flexible Contact Wheels and F-26 Abrasive Belt Grease Stick.

Descriptive Catalogs Sent on Request

FORMAX MFG. CORP.

DETROIT 7, MICHIGAN

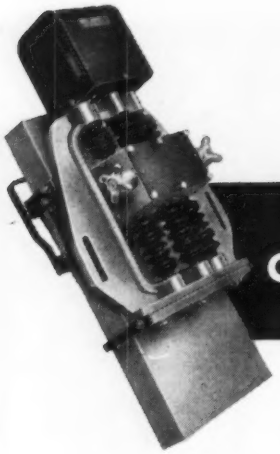
"THE FOUR McALEERS"

Neoprene Gloves

Charleston Rubber Co., Dept. MF, Stark Industrial Park, Charleston, S. C.

The Neo-Sol glove is the newest development in an all-neoprene industrial protective glove, just announced by the manufacturer. Its makers state that this glove has been proven conclusively, by approved laboratory tests and extensive on-the-job tests, to be superior to other leading neoprene gloves on the market. They further state that their glove was introduced only after two years of intensive laboratory research, experimentation and development of their exclusive formula and process.

The glove is a distinctive black glove



Brand New!

A NANKERVIS COMPOUND APPLICATOR FOR 10-INCH BARS

and it's Automatic!

Buffing l-a-r-g-e parts? Then here's a product to help you get better results, cut costs as well.

It's the new Nankervis Automatic Compound Applicator. Called the Model 610, the new applicator accommodates any cake up to 10 inches wide (2"x10"x24").

It is automatic in operation and is similar in construction to other models in the "600" Series. Air operated, it weighs forty pounds and can be installed on all types of buffing machines. All moving parts are bearing mounted to insure smooth operation and long life. Protective boots of molded Neoprene seal out all dirt, dust, lint and compound from the operating mechanisms.

Nankervis "600" Series Applicators can be operated from any air supply line equipped with a 3-way exhaust valve. This valve can be mechanically, electrically, or manually-operated depending on the buffing operation involved and the amount of compound desired. Each time the air valve is operated, the cake holder is thrust forward applying compound to the buff. The cake holder retracts, when the valve is released, pulling the compound away from the buff. Each time the cake holder is thrust forward, its relative position is advanced to compensate for wearing of the bar. This feed rate is adjustable from .0015" to .015" per stroke. (No 3-way valve is supplied as the choice of this component is dependent on the buffing operation involved.)

Instructions for installing, operating, and maintaining the applicator are included with each unit.

For Additional Information on This and Other Nankervis Applicators Write for Nankervis Technical Bulletin No. 600.

Nankervis COMPANY 19255 W. DAVISON AVE. • DETROIT 23, MICHIGAN

EQUIPMENT AND SUPPLIES FOR THE METAL-FINISHING INDUSTRY

with a red inner lining and a red roll at the cuff. It is made with curved fingers, for easy, natural use, and is available with either "Grip-Saf" hand or smooth finish. It is being manufactured in five sizes, four weights and in lengths from 10½ inches to 18 inches.

Selenium Plating Rectifiers

Kocour Company, Dept. MF, 4802 S. St. Louis Ave., Chicago 32, Ill.

The new Kocour selenium rectifier line meets every DC plating power supply requirement. These fine units are hand assembled and include rigidly pre-tested components of the highest quality. Conservatively rated with up to 11% more, scientifically matched

selenium stack area to insure continuous performance under full load operation. The heavy-duty liberally designed transformers are multiple coated to resist corrosive atmospheres and humidity. The unit is fan cooled, utilizing a ball bearing polyphase pre-greased motor.

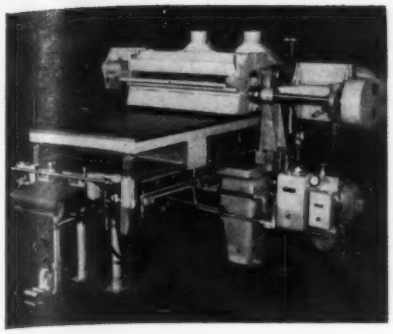
Stainless steel bi-metallic type thermal relays protects from fan failure or ventilation restriction. Bus bar extends from both sides of the cabinet to provide busing to load from either side and is liberally calculated at 1,000 mils per ampere. Line voltage reduced to 115 volts for further improvement of insulation factor and for safer maintenance. The new line of rectifiers includes: Bench rectifiers, with current ratings from 5 amperes to 200 amperes, including a variable output control. The economical basic rectifiers with a constant current output. These are available in various current outputs ranging from 250 to 5,000 amperes, at from 6 volts to 18 volts. Self-contained rectifiers include ammeter and voltmeter accurate to within 2% of full scale, a 22 step variable output control over half or full range, built-in electro-magnetic starter, all completely housed in one cabinet. Remotely controlled rectifier is a combination of a basic unit or units, with separately housed remote controls. Anodizing rectifiers are available with outputs of 18, 24, 36, & 48 volts.

All of these selenium plating rectifiers are housed in an industrial duty, heavy gauge steel cabinet, completely electro-welded, chrome primed and finished to resist corrosion and humidity.

Polishing Machine

Clair Mfg. Co., Inc., Dept. MF, 1009 Union St., Olean, N. Y.

A new heavy-duty surface finishing machine has a vacuum chuck for pro-



cessing items of non-magnetic materials.

A modification of an earlier machine, the Model 203-C was designed to provide greater capacity in the surface finishing of automobile trim and name plates for refrigerators, stoves and other appliances. It is recommended for processing items made of brass, copper, silver, plastic, aluminum, wood and other non-magnetic materials.

Completely new electrical control circuits offer a wide choice of either automatic or semi-automatic cyclic actuations. Side oscillation mechanism is located at mid-table rather than at the front and extreme ends as on other machines in the 203 series.

The added capacity comes from the larger vacuum table, a 40″ x 48″ unit as compared to 36″ x 38″ on the earlier model. Design of the vacuum chuck is such that even small items can be held and surface finished without interference with coverage over the entire surface.

Weighing approximately four tons, this machine has exceptionally heavy and rigid construction. It requires eight floor bearing supports instead of the four on the machine from which it was developed.

An added safety feature is the fact that failure of negative pneumatic chucking pressure stops the machine. Should vacuum drop below any safe predetermined setting the roll is automatically lifted from the work and all actuations stop instantly.

In the Model 203-C the floating buff will follow curvature of work at any uniform preset contact pressure. Both speed of table travel and buff pressure can be adjusted for individual predetermined values with respect to stroke in direction with and against rotation of the buff.

BUCKINGHAM
POLISHING
and
BUFFING COMPOSITIONS

- Stainless Steel Composition
- White Finish
- Tripoli
- Chrome Coloring Composition
- Greaseless Composition
- Emery Cake
- Brass Coloring
- Emery Paste
- Burring Compound
- Grease Stick
- Spray Pastes Stainless Steel Tripoli

Representation in Major Cities *Write Dep't. A for Samples*

The BUCKINGHAM PRODUCTS Co.
14100 FULLERTON AVE. • DETROIT 27, MICH.

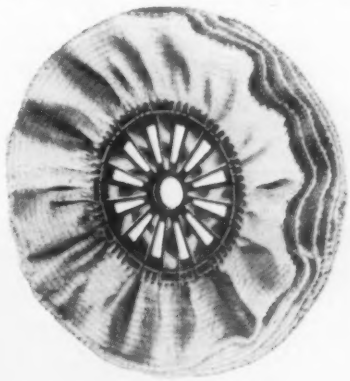
Open Bias Sisal Buff

American Buff Co., Dept. MF, 2414 S. La Salle St., Chicago 16, Ill.

Three of the most wanted buffing assets according to industrial requirements—extra-flexibility, long wear and extremely cool running — are now available in one new buff, the "Open" bias sisal buff.

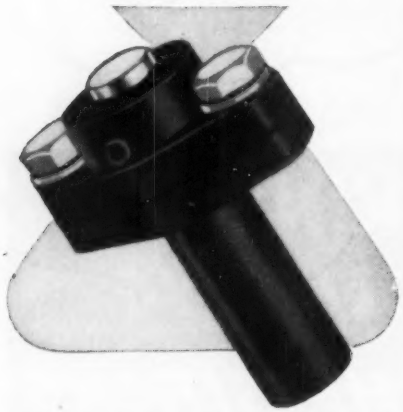
To attain these desired characteristics, the manufacturer has combined the outstanding features of both bias sisal and bias cloth buffs. The result is an extra-loose buff, ideal for getting into crevices and contoured surfaces and for speeding production on both flat and curved surfaces. Because of the unique open-faced construction, air is continually circulated through all parts, thereby maintaining cool operation for long periods of time and eliminating heat discoloration problems.

The new buffs are constructed of fast-cutting, top-grade bias-cut sisal



Du-Lite

"Gives our tools Sales Appeal"



BARNABY MFG. CO. of Bridgeport, Conn., reports: "Our close proximity to salt water has given us problems in rust prevention for many years. We have experimented with many black oxide finishes but none has proven as successful, safe, and inexpensive as DU-LITE—our tools have better sales appeal—our volume has been on the increase ever since we started using this modern, progressive oxide finish."

Depend on Du-Lite, the metal-finishing specialists, for the most efficient and economical cleaners, black oxide finishes and phosphate coatings. Write for full details on:

Du-Lite Black Oxide for Steel.

3-0 Black Oxide for stainless steel and malleable iron.

SD Compound for removing occluded salts.

Phosteel and Phospray for phosphatizing steel, iron or zinc.

Du-Lite Non-Acid Black Oxide for copper and copper alloys.

Dynakleen for bright cleaning all metals.

Kwikseal and Proctoil water displacing oils.

Or send us samples of parts and we will process them for your approval.

DU-LITE CHEMICAL CORP.
MIDDLETOWN, CONN.
Send more information on Du-Lite..... ☐
Send information on metal finishing products.. ☐
Have your representative call..... ☐

Name.....
Company.....
Address.....
City..... Zone..... State.....

Du-Lite
METAL FINISHING SPECIALISTS

fibers, locked together by the company's exclusive "Permanizing" process which eliminates loose ends and scratching. For maximum wear, the open bias sisal buff is available with cloth covering, or in 100% sisal models.

The buff comes with either "air conditioned" permanent centers and patented "Centerless" construction. All "open" type models are made specifically for economical, highest quality buffing of stainless steel, carbon steel, and aluminum.

Plastic Pipe

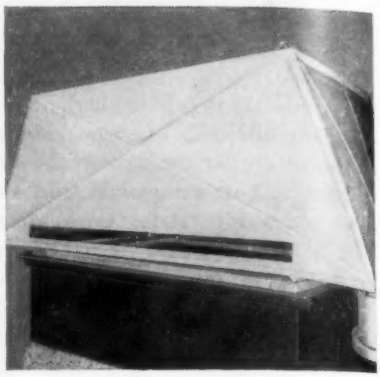
American Hard Rubber Co., Dept. MF, 93 Worth St., New York 13, N. Y.

A new corrosion-resistant, rigid plastic pipe with exceptional impact resistance and toughness, called Dur-Ace, is a general-purpose material capable of handling most common corrosives, with a favorable cost factor. It has excellent resistance to all inorganic acids and alkalis with exception of a few strong acids.

The pipe is now supplied in sizes from ½ to 2 in., in standard 20-ft. lengths, with choice of two wall thicknesses, Extra Heavy Duty (IPS Schedule 80), and Standard (IPS Schedule 40). Fittings, flanges, nipples, etc., are also available, with standard IPS threads. The pipe is easily threaded with standard pipe threading tools or threading machines and can be bent in regular pipe forming equipment if it is first heated to soften it.

Working pressures at 70 deg. F. for the extra-heavy-wall pipe range from 300 psi. for ½ in. pipe to 150 psi. for 2-in. pipe. Standard-wall working pressures range from 150 psi. for ½ in. pipe to 75 psi. for 2-in. pipe. Maximum working pressures of thermoplastic pipe are reduced as temperature goes up, and the value for the new product at 170 deg. F. is about

THIS PLA-TANK® HOOD SAVED ITS COST IN A YEAR



The PLA-TANK Hood shown above has been in continuous use at General Electric's small aircraft engine department in West Lynn, Mass., for over a year. Reports indicate that it is still as good as when originally installed, is already credited with saving its entire cost since no previously used material had lasted over a year.

The tank is used for etching stainless steel billets; solutions used are aqua regia at room temperature and a 50% solution of muriatic acid at 180°F. PLA-TANK has successfully withstood these fumes, where other materials failed.

PLA-TANK products are daily solving problems of all types in the chemical and electroplating fields. They replace or outlast stainless steel, lead and ceramic linings, plywood coated with corrosion preventatives, phenolic plastics and asbestos cement board structures in many applications.

PLA-TANK, molded from long-life, resin-bonded glass fibre laminate, is now resistant to a wider variety of fumes and temperatures than ever before. PLA-TANK is light weight, easy to install, competitively priced.

Let us help you solve your problems the modern way — with PLA-TANK. Write today for free data sheets. P-21

THE Chemical CORPORATION
58 Waltham Ave., Springfield 9, Mass.

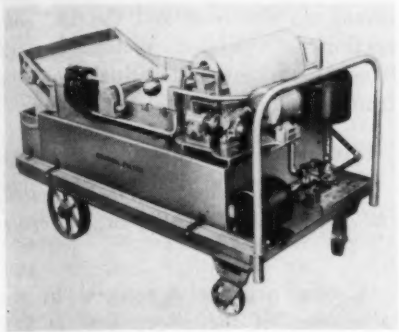
half that at 70 deg. F. These working pressures are based on a safety factor of 5 to 1.

The pipe is not recommended for temperatures above 170 deg. F., nor for temperatures below minus 20 deg. F. where physical shock is present.

Like most other Ace materials, the new plastic can also be supplied as special custom molded parts and fittings, as well as tubing or special extruded and fabricated parts.

Portable Filtration Unit

Industrial Filtration Co., Dept. MF, Lebanon, Ind.



A new portable filtration unit incorporating the famous Delpark disposable belt-type filter is mounted on casters and is easily transported for periodic filtration of various liquids and oils which do not require continuous filtration. These units make use of a variety of filter media for numerous filtration requirements. The filter is known for its new and unique principle of continuous and automatic filtration.

Bright Copper Process

Jelco Finishing Equip. Corp., Dept. MF, 153 East 26th St., New York 10, N. Y.

The above firm has announced the addition of a new brightener to an already expanding line of research products. It is called Cop-Brite and is used both in still and barrel plating solutions.

It is claimed that this one-material liquid brightener will produce a highly reflective, softer, smoother finish. In order to extend the current density range, an agitated bath is preferred, but brightness is also obtained in a nonagitated bath. The process permits flexibility of operation and greater economy.

Further information may be obtained by writing to the above address.

Edmont Case No. 529: Handling racks to and from plating tanks. Unsupported rubber gloves were replaced with Edmont gauntlets coated with Neox (reinforced neoprene). User's report: "Best gloves ever used, outlasting gloves previously used many times."

Job-fitted gloves wear longer, save up to 70%

No. 366—Coated with Durox, a 50% longer wearing plastic.

No. 924—Coated with Neox, chemical and wear resistant.

With Edmont gloves, job-fitted for the application, you get maximum protection against hand injuries and cost savings averaging 40% to 70% through longer wear.

In handling sharp, abrasive or slippery materials, or where chemicals, grease or heat are present, modern Edmont gloves made of coated fabric have widely replaced canvas, leather and unlined rubber gloves. Their coatings far exceed these older materials in resistance to acids, caustics, solvents, snagging and cutting action, abrasion and other conditions. They also provide safer, surer handling, and result in improved employee morale.

Edmont Case No. 419: Working in acids and strong solvents. Job-fitted gloves coated with Neox outwore rubber coated gloves more than 4 to 1.

Edmont Case No. 207: Handling sharp-edged metal products in plating solution, Edmont gloves reduced hand injuries 78%. Also saved 6c per man-hour on cost of glove replacements.

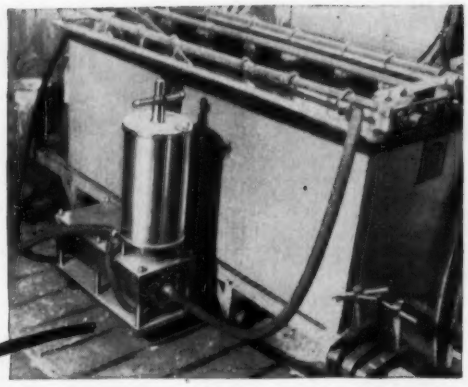
Free Test Offer to Employers: Edmont's laboratories have developed and test-rated over 50 types of palm-coated or fully-coated gloves to fit different job conditions. Send description of your operation, materials handled and temperature condition. We will recommend the glove that best fits your application and forward samples free of cost for testing on the job.

Edmont Manufacturing Company, 1276 Walnut Street, Coshocton, Ohio

World's largest maker of coated industrial gloves, available through leading industrial suppliers.

Edmont job-fitted gloves

CHECK the advantages



of using a "Sealed-Disc" Filter

YOU'LL . . . . . be impressed too . . . . . with these proved performance features.

Models for any size or type installation in Stainless Steel, Monel Metal, Plain Iron, etc.

Small, compact — requires exceptionally small floor space coupled with remarkable filtering speed and volume.

Completely enclosed and air tight — eliminates loss of liquid from dripping.

"Sealed-Disc" Filters are complete as shown — slurry mixing tanks are not needed — filtering powders are not generally required.

Simplicity of design assures savings in operating time and labor with positive trouble-free performance.

Every plater who uses a "Sealed-Disc" Filter is impressed with it's positive, trouble-free performance.

Regardless of the size or type of your plating installation, there's a "Sealed-Disc" Filter "to fit your job" — you can depend on these proved performance features — you can be sure that all dirt, sludge, and even the invisible impurities are removed from your plating solutions.

"Sealed-Disc" Filters were designed especially to meet plating room requirements. They are smaller, more compact and portable than ordinary Filters, yet they are capable of handling equal volumes of solutions. Ask your regular plating supplier to tell you about the "Sealed-Disc" Filter that has helped so many platers get better finished plated work with savings in time and labor — or write for details.

ALSOP ENGINEERING CORPORATION

910 Bright Street Milldale, Conn.

Other Alsop plating room equipment

We manufacture a full line of Mixers and Agitators covering a complete range of sizes, for mixing, blending and dissolving. Stainless Steel Mixing Tanks are also available in a wide range of capacities. For full details and illustrations write for your free catalogue.

Heavy Duty Electrocleaner

Pennsylvania Salt Mfg. Co., Dept. MF, 1000 Widener Bldg. Philadelphia 7, Pa.

Announced recently was the introduction of a new, heavy duty electrocleaner known as Pennsalt Cleaner K-8.

Recommended for use on steel and copper, it provides excellent detergency properties with unusual ability to remove mill oil and smut from steel prior to electroplating. This is accomplished through a new concept in the use of surface active agents.

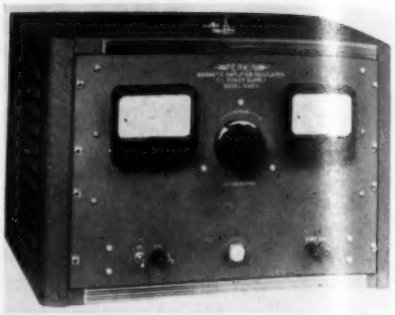
The cleaner is a granular, anhydrous product containing 100% active ingredients which resist neutralization by acid soils and provides excellent electrical conductivity. It is resistant to the effects of hard water and is free rinsing.

Especially recommended for use at 4 to 12 oz./gal. at 210° F. with 75-100 amps. per square foot to take free advantage of the high conductivity, cleaning time will vary from ½ to 2 minutes depending on the applications.

0-32 Volt 25 Ampere Power Supply

The Perkin Engineering Corp., Dept. MF, 345 Kansas St., El Segundo, Calif.

Recently announced is the development of a 0-32 volt, 25 ampere power supply which features a ±1% regulation and a ripple of 1% rms. The unit is designed for 115 volt,, single



phase, 60 cycle AC input and it weighs 130 lbs. It has a baked grey wrinkle finish and has the dimensions: 19" wide x 15" deep x 12¼" high. Its AC connection is provided with a three-prong, twist-lock Hubbell connector on the rear and the DC connection is available in the form of five-way Superior terminals on the front and a Jones strip on the rear.

Chromate Conversion Coating

Kosmos Electro-Finishing Research, Inc., Dept. MF, 13 Valley St., Belleville, N. J.

A new product developed by the laboratory of the above firm is Ker-Chro-Mite No. 1. The material is a chromate type solution in a concentrated form. It is used for chemical polishing and passivating zinc and its alloys and cadmium and its alloys. The process is so simple it needs hardly any control other than daily additions to replenish the bath. For lustrous finish the cost is about $0.001-$0.002 per square foot of surface, of industrial zinc or cadmium plate. For protective finish of the above metals, the cost is about $0.0003 to $0.0005/ sq. ft. The effort to develop the above product was directed toward the end of producing a material which can be used by the average shop help, to produce consistently good results without the aid of technical control. The solution can be used at room temperature or slightly warm. It can be used for still as well as for automatic conveyors.

Cold Degreasing Solvent

The Dow Chemical Co., Dept. MF, Midland, Mich.

The first large-scale production of a new nonflammable solvent for use in the metal and metal working industries has been announced.

The product is Chlorothene (Inhibited 1, 1, 1-Trichloroethane), which fulfills the industrial need for a low-toxicity, nonflammable solvent to be

used in cold cleaning and cold degreasing operations. It is particularly suited for these and other applications formerly reserved for the more toxic or more flammable solvents.

Although 1, 1, 1-Trichloroethane by itself may corrode aluminum and aluminum alloys, the new inhibited grade virtually eliminates such corrosion except under the most drastic conditions.

As sole producer, the company is now manufacturing the solvent at its Texas Division, and it will be marketed on a freight allowed basis.

Photosensitive, Anodized Aluminum Sheets

Metalphoto Corporation, Dept. MF, 2903 E. 79th St., Cleveland, O.

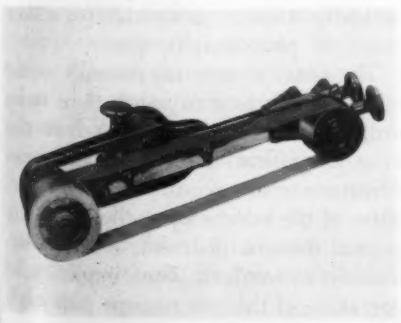
Complete rights to manufacture and sell photosensitive, anodized aluminum sheets, designed for photographic reproduction using standard darkroom techniques, has been announced by the above company.

The new product, known as Metalphoto, and which was originally developed by Horizons, Inc., also of Cleveland, involves the use of aluminum sheets which measure 0.020 inches in thickness, and which are available in sizes of 4″ x 5″, 8″ x 10″ and 10″ x 12″. Applications already proven include the use of the product in the making of such products as name plates, dial and watch faces, wiring diagrams, instructions, instrument and slide rule scales, and other products where resistance to abrasion, temperatures up to 1,000°F., and acids, salts, and organic solvents are important considerations.

Contact Wheel Belt Grinder

B. & E. Mfg. Co., Dept. MF, 407 Liberty St., Kansas City, Mo.

Model 500 Contact Wheel Belt Grinder is claimed to increase production 20% or more over old grinding methods. It is among the first to offer flexibility and maneuverability and can be mounted on a bench, pillar, portable table or most any convenient place in the shop. An adjustment of 360 degrees vertically is part of its unique and original design. It is instantly adjustable to the most advantageous point for visual and physical comfort of the operator.



Full Automatic Plating Barrel Conveyor

The Udylite Corp., Dept. MF, 1651 E. Grand Blvd., Detroit 11, Mich.

The new conveyor shown in the accompanying photograph is of the return type using the standard Udylite horizontal barrel plating cylinder.

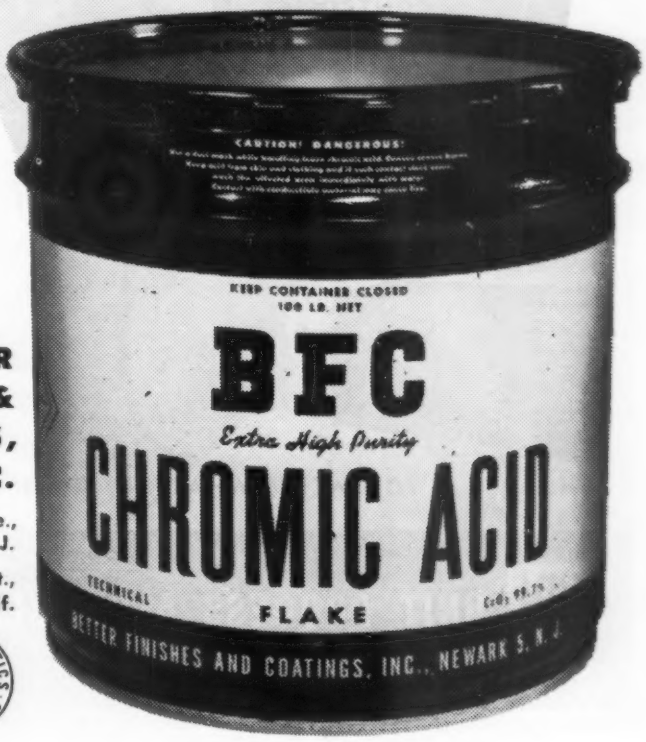
Illustrated is a machine with 24 cylinders, 14 inches in diameter by 30 inches long inside dimensions, to produce 3,000 to 6,000 lbs. of plated work per hour. This is a heavy duty, high production plating machine. The chassis is rigidly constructed, using a maximum fiber stress of 10,000 lbs. per square inch and highest quality materials are used throughout.

The machine is remarkably flexible because of timer controlled speed and power operated skip transfers. The R.P.M. of the cylinder can be changed; as an example, cylinders in cleaning and plating can operate at one speed, and cylinders in dichromating and subsequent tanks can operate at a much lower speed. All cylinders are

Nice Product, Nice Package

Folks often wonder why we spend an extra ¼¢ a pound out of our own pockets for a lithographed drum. Fact is we're proud of the quality of BFC Chromic Acid and figure it deserves a bright, colorful container.

Every batch gets checked against a tough quality spec. Off-grade acid goes on the dump. Only top-quality material goes into those shiny BFC drums. Send us a modest order and see for yourself.



BETTER FINISHES & COATINGS, INC.

268 Doremus Ave., Newark 5, N. J.

122 East 7th St., Los Angeles 14, Calif.

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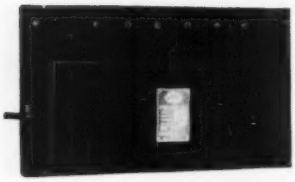
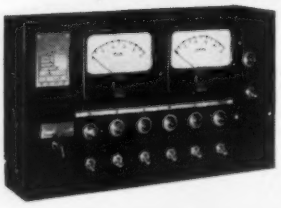
APC AUTOMATIC PLATING CONTROLLER

THE FIRST AND ONLY *Automatic* RHEOSTAT

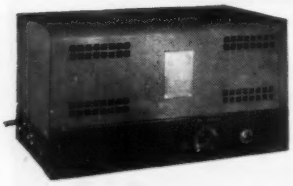
REGULATOR UNIT



CONTROL PANEL



ELECTRONIC BRAIN



Eliminate setting switches during loading and unloading of tanks — Remove the possibility of "burning" small loads — Automatically controls the tank current — Adjusts to all loads and all solutions — Automatically checks if work is added or removed — Plates all work at the proper current — Operates at remote location if desired — Gives you control by the electronic "brain" of the future . . . TODAY!

Stop wasting time with manual controls — *Write now for literature and a quotation form for a unit to fit your exact operation.*

THE A.P.C. IS TO PLATING WHAT "NO-SHIFT" IS TO DRIVING

UPA **UNIT PROCESS ASSEMBLIES, INC.**
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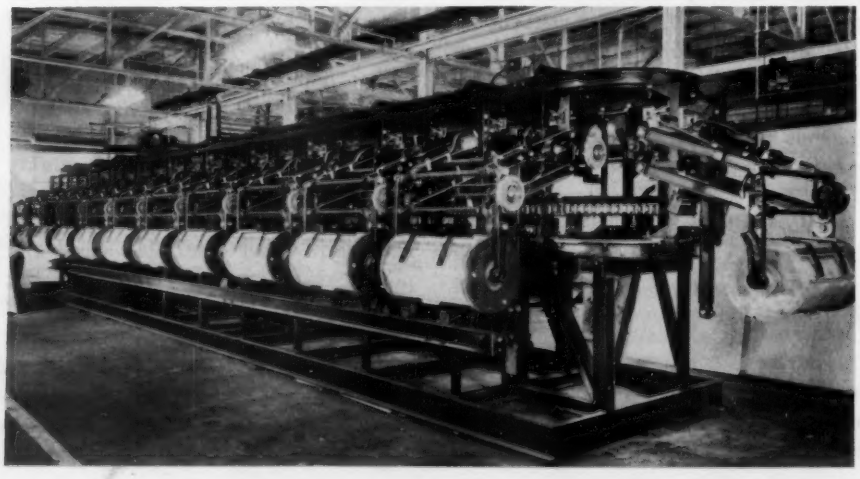
MFGRS. OF PERIODIC REVERSE UNITS AND ELECTRONIC EQUIPMENT FOR THE PLATING INDUSTRY

potentially capable of individual lowering or raising.

Cylinders of Tempron or acrylic resin are offered with this machine. It takes full advantage of the excellent tumbling conditions with uniform distribution of deposit which are inherent qualities of the horizontal cylinders. The cylinders, which are easily removed from the machine, revolve in a trough of anodes in the plating tank; the anodes are on both sides of the cylinders. With the conforming anode containers, the solution resistance is held at a minimum.



The machine is engineered so that none of the operating mechanism is over the tanks except vee-belt drives which will not rust. The cylinders rotate when raising and lowering thus greatly reducing drag-out losses and solution contamination. Separate chains are used for the conveyor and for the elevating; this means that the stress of elevating does not come on the conveyor chain.

The machine is electrically and mechanically operated. Cylinders may be left in the elevated position (over hot tanks) overnight or during a weekend. The machine is accessible from the inside as well as the outside. The bottom of the tanks is about 18 inches above the floor.

A power operated hopper, with weighing scale, is used for loading the machine—to raise the hopper the operator simply pushes a button. The plated work is dried after it is unloaded from the machine. This is conducive to efficiency because the work, not the barrel, is dried. The drying is done in the conventional drum type drier, or centrifuge, or the machine is equipped with heated air operated chutes, electrically controlled.

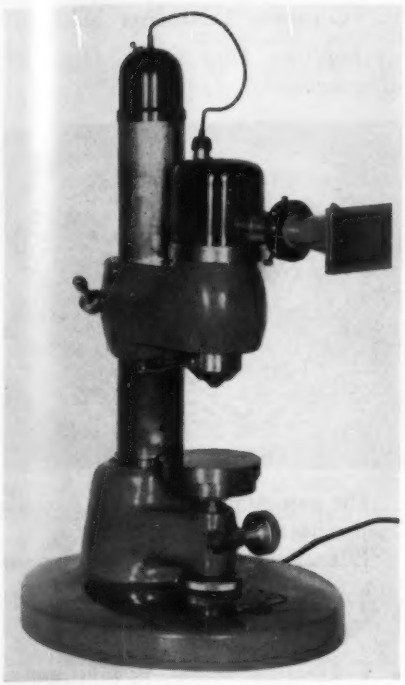
Interference Microscope for Measuring Surface Roughness and Finish

Farrand Optical Co., Inc., Dept. MF, Bronx Blvd. & E. 238th St., New York 70, N. Y.

The Farrand Interference Microscope is a versatile instrument developed for measuring smoothness or roughness of polished, lapped and ground surfaces of any material.

It is a high-power, high-resolution, optical instrument adaptable for either visual or photographic use.

The interference microscope is no more difficult to manipulate than is an ordinary microscope operated at the same magnification. No high precision adjustments are required in the operation of the microscope other than the normal focus adjustment, which is extremely convenient. The simplicity of operation of this microscope puts high



precision interferometry and the possibility of measurement of surface roughnesses of the order of one microinch in the category of a shop tool rather than a highly complex laboratory instrument.

The microscope has advantages over electronic and mechanical types of surface measuring instruments in the following respects:

It enables more precise and detailed measurement of surface irregularities whose surface rate of change is too small to be measured or detected by electro-mechanical means because the latter only give an average contour measurement.

Bulletin No. 818, describing two models, available upon request from the company.

Tripoli Buffing Compound

The Lea Mfg. Co., Dept. MF, 16 Cherry Ave., Waterbury 20, Conn.

Learok Tripoli TP42X is a new, fast cutting, clean working Tripoli composition for buffing all non-ferrous metals. This new composition is formulated to give extra bar strength for automatic buffing with mechanical applicators and operating economies are effected through more work per bar due to new formulation of the compound. Strength of bar is not affected by elevated temperatures commonly met with in summer months. Bar sizes manufactured to specifications in widths of 2″ or more and any length or shape. Samples available on request.

Hammond of KALAMAZOO FOR DEBURRING

Model 50-DD

IRREGULAR SHAPES

FLAT WORK

CONTACT WHEEL

CONTOURED PARTS

HARD-TO-GET AREAS

It is amazing how soon these Abrasive Belt Machines pay for themselves.

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Hammond Machinery Builders INC.

1601 DOUGLAS AVENUE KALAMAZOO, MICHIGAN

SEE US AT BOOTH 1142 — NATIONAL METAL EXPOSITION

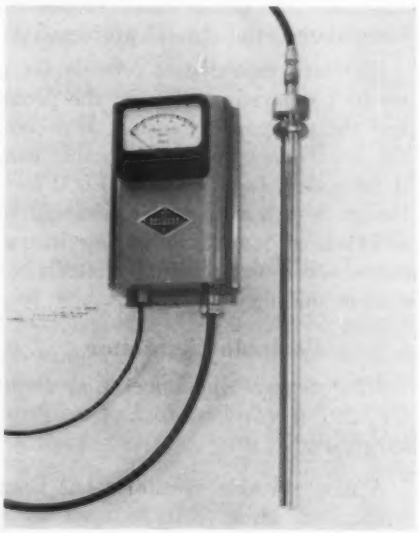
Capacitive Level Indicator

Thermo Instruments Co., Dept. MF, 1310 County Road, Belmont, Cal.

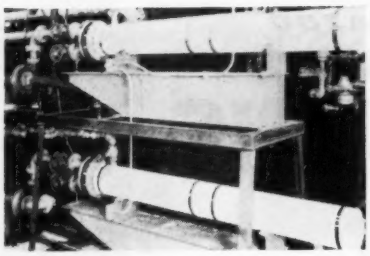
Capable of providing a continuous indication of level for a wide range of materials in storage or process, the new Level Indicator utilizes a capacitive-type sensing-element probe with no floating or moving parts nor contact-making electrodes.

Suitable for use with most non- adhesive chemicals, the instrument is operable over a temperature range of 500 to -425F., and from high vacuum to 100,000 psi.

Various probe lengths, materials, and designs are available to cover dif-



HERE'S THE ANSWER TO YOUR ACID HEATING OR COOLING PROBLEM

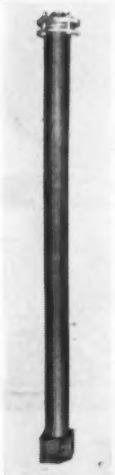


HEIL 1277 SHELL AND TUBE EXCHANGER WITH NOCORDAL* TUBES

PUT NOCORDAL*

*Trademark

IMPERVIOUS GRAPHITE HEATING AND COOLING UNITS TO WORK FOR YOU



STEAM JET AGITATOR

1. **LONGER SERVICE LIFE** . . . Nocordal is Practically Inert to Most Strong Acid Solutions.
2. **YOU SAVE TIME AND MONEY**... Pre-Engineered Standard Units Available in Field Tested Designs.
3. **LOWER OPERATING COST** . . . Superior Heat Transfer Characteristics Coupled with Efficient Design.

STANDARD DESIGNS AVAILABLE FOR

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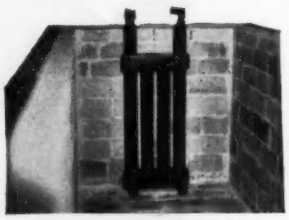
- Immersion Coils
- Electric Units
- Jet Agitators



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HEIL PROCESS EQUIPMENT CORPORATION

12901 Elmwood Avenue • Cleveland 11, Ohio

HEIL Products are Sold Through Leading Electroplating Jobbers

ferent ranges in the rise and fall of materials, the character of substances encountered, and special problems.

Standard instruments provide for a ten-foot separation between the probe and the equipment housing. However, the interconnecting coaxial cable can, if necessary, be as long as 1,000 feet. Design is such as to permit inexpensive addition of remote indicating instruments over telemetering circuits of almost unlimited length.

Portable Ventilator

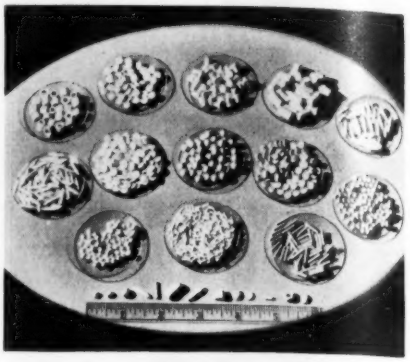
Mine Safety Appliances Co., Dept. MF, 201 North Braddock Ave., Pittsburgh, Pa.

A new portable ventilator has been announced which can be used as a blower or as an exhauster. The two-way ventilating system is a compact, easily portable ventilator which is said to have many applications in a variety of industries. It may be used either with or without the accompanying collapsible air duct. With its duct, the MSA portable ventilator is described as ideal for ventilating confined areas which cannot be reached satisfactorily by conventional types of stationary ventilating equipment.

It is driven by a powerful 3450 r.p.m., explosion-proof electric motor, capable of moving approximately 3,000 cubic feet of air per minute. The ventilator is supplied complete with 15 feet of three-wire electrical cable, and a 15-foot length of 14-inch diameter duct, and two carrying belts.

Ceramic Tumbling Media

American Lava Corp., Dept. MF, Chattanooga 5, Tenn.



The new AlSiMag ceramic tumbling media have these advantages:

1. Extremely hard and wear resistant.
2. Chemically inert.
3. Can be used wet or dry.
4. Light in weight, specific gravity from 2.0 to 4.0, depending on composition.
5. Many standard sizes and shapes of media are now available. Custom made sizes and shapes available promptly at reasonable cost.
6. Selection of the most favorable size, shape and weight of media can greatly improve quality, reduce tumbling time and cost.

Samples of the new tumbling media sent on request.

Aluminum Coated Steel Wire

Page Steel and Wire Div., American Chain & Cable Co., Inc., Dept. MF, Monessen, Pa.

An aluminum coated wire, which for the first time is said to provide accurate control of both thickness and weight of the coating, is now available. Named Acco Aluminized by its manufacturer, application of the aluminum coating is made through a new continuous hot-dip process.

Intended for applications requiring superior resistance to corrosive conditions, the coating is bonded tightly to its metal base and is so ductile that it can be drawn to any desired thickness. Based on coatings of equal thickness to that of zinc, resistance to weathering in industrial atmospheres is expected to be 2 to 20 times as long.

Tested under severe operating conditions for the past few years in research and pilot plant operations, the product is now available in Aluminized 7-Wire strand in Siemens-Martin. High Strength and Utility. Physical proper-

ties conform to ASTM Specification A-122-52-T for galvanized strand. Aluminum coatings are comparable in thickness to that of Grade A galvanizing. Since physical properties match those of galvanized strand, the same sag tables or charts may be used.

Pickling Inhibitor

Thor Chemical & Equipment Corp., Dept. MF, 77 South 5th St., Brooklyn 11, N. Y.

Thor Inhibitor is a simple additive to pickling acids and cleaning acids which will allow the acid to uniformly and rapidly remove rust and scale from steel; it will prevent attack on the clean base metal without retarding the efficiency of the acid; it will put a slight foam blanket over the surface of the acid, thus preventing fuming throughout the plant; it will save a high percentage of the acid used by not being wasted in attack of clean base metal; it removes only scale and oxide, and does not etch or roughen base metal; it prevents rusting on acid treated parts after drying. Whether used in the acid or used as a subsequent rinse in water, steel parts treated with the inhibitor show no signs of rust after almost a month, while other parts similarly treated show rust within 48 hours.

Ultrasonic Generator

Rich-Roth Laboratories, Dept. MF, 1240 Main St., Hartford, Conn.

The above firm announces the Rich-Roth "400" — a wide-range, 400 watt ultrasonic energy generator, and with it a variety of transducers for production line or laboratory degreasing, emulsifying, etc.

The generator is continuously tunable over the frequency range from 10 to 1,200 Kc./sec. Ready selection of output impedances couples the generator to many types of piezoelectric and magnetostrictive transducers.

New types of transducers include metal jacketed and lined fully enclosed water cooled treatment chambers in which the process materials are in contact only with metal surfaces. Another new type is a flanged flow-through chamber which can be bolted into a pipe line for continuous processing of materials. Expendable transducers for experimental purposes also are offered.

The combination of simple operation, wide range of frequency and output impedance, generous choice of transducers and sound field configurations are claimed to make the generator the first ultrasonic energy source equally suited for industrial and laboratory installation.

Further information may be obtained from the manufacturer.

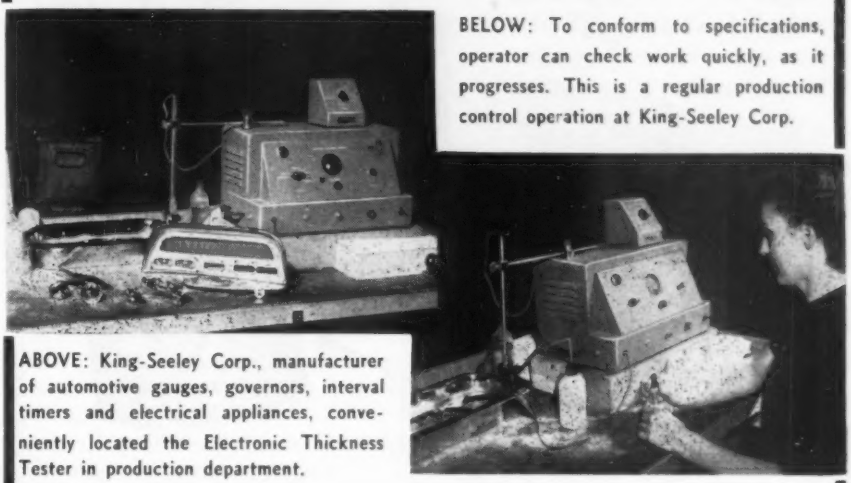
All-Purpose Filter

Metal Finishing Mfg. Corp., Dept. MF, 89 N. 11th St., Brooklyn 11, N. Y.

After several years of successful testing in the field, the new Placo self-priming and self-relieving filter unit is now ready for national distribution, it was announced recently.

Constructed of type 316 stainless steel, these units are ideal for filtering all acid and alkaline solutions. Long-life Neoprene impeller, large graphite bearings and ball bearing ring enclosed motors assure convenient, trouble-free operation under any conditions. The new unit filters in depth, through cartridges of cotton, Dynel and carbon, making possible micro-

KING-SEELEY CORPORATION, ANN ARBOR, MICHIGAN
solves thickness testing problem with
KOCOUR ELECTRONIC THICKNESS TESTER



BELOW: To conform to specifications, operator can check work quickly, as it progresses. This is a regular production control operation at King-Seeley Corp.

ABOVE: King-Seeley Corp., manufacturer of automotive gauges, governors, interval timers and electrical appliances, conveniently located the Electronic Thickness Tester in production department.

About 2 years ago the King-Seeley Corp. purchased the Kocour Electronic Thickness Tester . . . evaluated the instrument and have been using it since with confidence and satisfaction. Mr. C. F. Waite of that company wrote a paper, "Thickness of Electrodeposited Coatings by the Anodic Solution Method" concerning their problems and how they were solved.

King-Seeley Corp. is one of the many companies which are now saving hours of control and production time with the Electronic Thickness Tester. In addition, more efficient operation and higher standards of quality can be maintained confidently.

Why not investigate the possibilities today. See how the Kocour Electronic Thickness Tester can solve your problems. Write for literature and get your copy of "Thickness of Electrodeposited Coatings by the Anodic Solution Method."

KOCOUR COMPANY
4802 S. ST. LOUIS AVE.,
CHICAGO 32, ILLINOIS

Always specify KOCOUR TEST SETS from your supplier!

A Greasless Compound that Counts

There must be a reason! Sales of SPEEDIE Satin Finish are going up, Up, UP! . . . by the proverbial leaps and bounds. What's the reason? SPEEDIE Satin Finish really *sticks* to the wheel — giving a finish that is unmatched. Here's one way to save money on *your* greaseless . . . and you'll *like* to use SPEEDIE Satin Finish — because it is *colored red*, enabling the buffer to know at all times how much compound he has on his wheel . . . a second SPEEDIE method of saving you dollars.

SPEEDIE Satin Finish is available in all size grits, from No. 80 for polishing, through No. 400 for the finest finish. Here is a uniform product well worth investigating.

Write today for samples of SPEEDIE Satin Finish, advising grit size and number of tubes required. And inquire about the complete line of efficient and economical SPEEDIE Buffing & Polishing Compositions.

Polishing Room Supplies and Equipment

BP THE BUCKEYE PRODUCTS CO.
7033 Vine Street Cincinnati 16, Ohio
Cable address: Buckprod

scopic clarification, including removal of colloidal solids.

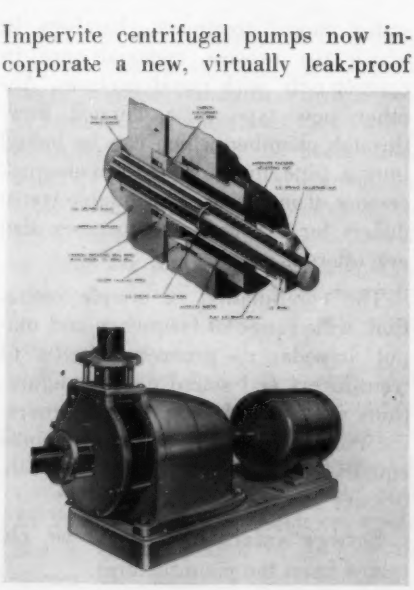
No priming is necessary to operate the filter; a flick of the switch starts crystal-clear filtration at full pressure. When the filter is loaded with impurities, the flow rate is automatically reduced to a trickle to warn that cartridge needs cleaning or replacement.

Economical to buy and maintain, the filter units are available with capacities from 60 to 1,600 gallons per hour. Also in steel or rubber-lined models, with Worthite pumps.

Impervious Graphite Pump

Falls Industries, Inc., Dept. MF, 31781 Aurora Road, Solon, O.

The recently re-designed line of Impervite centrifugal pumps now incorporate a new, virtually leak-proof pump seal developed and produced by the above company. This new seal is fabricated from impervious graphite, features a simple, self-cooled rotary section, and is easily accessible.



Among other outstanding design advances are over-sized bearings and heavy stainless steel shaft. In addition, the shaft and the impeller are made as two separate and independent components, which permits quick, simplified, inexpensive maintenance.

These new pumps are designed for intermittent or continuous handling of almost all corrosives such as hydrochloric acid, nickel plating solution, chlorinated organics, rayon spin bath, etc. All components contacting the corrosive are made from resin-impregnated graphite, and these parts are protected with heavy-duty cast iron plates. Accurate machining is designed to give precision balance to all rotating parts. When necessary, this pump can be completely stripped down on the job in as little time as 90 minutes.

The product retains the chemical resistance properties of graphite, but is rendered completely nonporous by the impregnation of special resins. It is immune to the effects of thermal shock, is impervious to the action of a wide range of acids, alkalies, salts, solvents and organics at temperatures to 340°F., and has an extremely low coefficient of expansion.

Six models of this new pump are currently available in capacities from 25 to 200 gallons per minute at heads of 20 to 100 feet. Motors are furnished at 1,150 or 1,750 r.p.m. depending upon requirements.

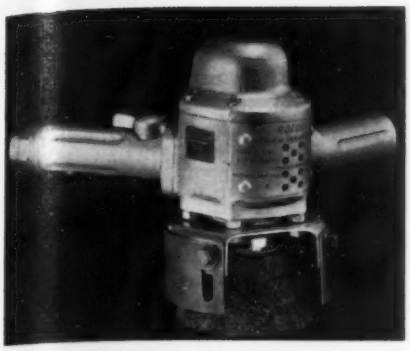
The overall advantages gained by this new heavy-duty, leak-proof, simplified pump design include less expensive fabrication and greater operating economy through less maintenance, the manufacturer states.

Portable Tool

The Rotor Tool Co., Dept. MF, 26300 Lakeland Blvd., Cleveland 23, O.

A new lightweight vertical grinder for cup wheels, cut-off wheels, sanding pads and wire brushes weighing only 6¾ lbs. and measures only 5½″ to top of spindle washer or an overall height (including spindle) of 7″. This height is most desirable for getting into close quarters.

Speeds of 8,000, 6,000 and 4,500 R.P.M. are listed and the tool has exceptional power. Speed is controlled



by quick acting governor threaded into rotor shaft. This feature eliminates rocker arm and simplifies maintenance.

The dead handle is removable for one handed operation and live handle can be installed in any of four positions for operator's requirement. Automatic oiler and air strainer are built-in. The safety handle is optional equipment.

The magnesium motor housing is protected against hard wear by a steel band opposite handles. Helicoil steel thread inserts are used for strengthening cast parts. Guards for cup wheels or cut-off wheels are standard equipment.

Solvent Cleaning Machine

The Alvey-Ferguson Co., Dept. MF, 1170 Disney St., Cincinnati 9, Ohio.

A special cleaning machine using low-flash petroleum type cleaning solvents has been designed, engineered and built by the above company, for a large bearing manufacturer to remove grinding residue and shop dirt from precision ball bearing parts before assembly.

The bearing parts, carried through the machine in baskets on a power driven roller conveyor, pass through a three-phase cleaning process; two washing operations and a blow-off to remove excess solvent. A petroleum type solvent is used to prevent rust before, and during, final assembly.

Like all other company cleaning machines, this model employes an A-F Super-Spray cleansing system. The bearing parts pass through consecutive high-pressure, fan shaped curtains of low-flash petroleum type solvent. Both emulsion and alkali cleaning solutions can be used in this machine. Solvent filtration is accomplished by a screen tank having two independent screens enabling one screen to be removed for cleaning without interrupting the cleaning operation.

An automatic fire extinguishing and fire control system is standard equipment when machine is designed for use with petroleum type solvents. The entire system is activated by a sudden temperature rise in the machine. Internally, the machine is equipped with an automatic CO_2 fog system; fire control is accomplished by an automatic closing of duct dampers and fan shut-off to isolate the fire.

Foremost in Quality . . .

Sel-Rex

Completely Sealed

SELENIUM RECTIFIERS

If a manufacturer intends to maintain a prominent position in a highly competitive business, his production equipment must be the most modern and efficient made.

SEL-REX places no limitation on engineering to achieve the finest DC power plant . . . nor compromise in the choice of component parts to "bring the cost down." True, such a policy may reflect a slightly higher initial cost . . . but in the long run a SEL-REX UNIT is the most economical. There are no moving parts to wear out — no maintenance expense, no loss of production.

SEL-REX RECTIFIERS available for every requirement from 25 to 50,000 amperes including completely sealed water cooled and air cooled models.

Write for complete details.

NEMA

BART-MESSING CORPORATION

Dept. MF-10 229 Main Street, Belleville 9, N. J.

Phosphate Conversion Coating

Municipal Steel Corp., Chemical Div., Dept. MF, 1225 Broadway, New York 1, N. Y.

The above firm announces the availability of FerRoSeal, a liquid which chemically converts rust into a protective iron phosphate coating. New to America, this product is said to be the only cold phosphating treatment for rusted iron and steel. It is a patented process and the registered trade name for one of the products developed by the Walterisation Co., Ltd., of Croyden, England.

It is claimed that this process requires only the wire brushing off of scale and loose rust. Subsequent water rinsing is also said to be unnecessary because there are no harmful chemicals which must be washed off.

The distributor states that the material is not an additive, and that it works in harmony with coal tar products, asphaltum, gilsonite, vinyls, silicones, Neoprene, zinc base materials, and other coatings as well as paint. One gallon is said to cover a metal surface area of about 1,000 to 1,500 square feet, depending upon the thickness of the rust layer.

Do you know the TECHNIC METHOD of Electroplating

RHODIUM?

Heavy rhodium electroplating—in thicknesses up to .001"—is now entirely practicable. Using Technic solutions and controlled equipment, you can impart the properties of pure rhodium to base metals. Our method suggests applications throughout industry to solve problems that have long baffled design engineers.

Recommended Applications

—include use of rhodium wherever extremely corrosive conditions are encountered. Very hard and resistant to wear, rhodium remains tarnish-free in all atmospheres, is unaffected by acids, alkalies or salts. If you are now plating rhodium, we can equip you to do better work at lower cost—if you have not yet taken advantage of rhodium's unique qualities, we can equip you to do low-cost electroplating with scientifically controlled results.

Without obligation, send us your problems for study

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Providence, Rhode Island, U. S. A.
JAckson 1-4200

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THE LARGEST ENTERPRISE OF ITS KIND IN THE WORLD

LETTER TO THE EDITOR

Finishing Publications, Inc.
381 Broadway
Westwood, New Jersey

Attention: Mr. Nathaniel Hall,
Technical Editor

Dear Mr. Hall:

We were very pleased to see your editorial "Finishing Specifications," appearing in the July issue of METAL FINISHING.

All of us who do specification plating for others, at one time or another have been confronted with problems for which the advice contained in the last paragraph of your article would be the ideal solution.

Unfortunately, your editorial in METAL FINISHING will be seen and read mostly by those of us who are confronted with the problem when it is too late. Manufacturers of articles to be plated, as well as designers of tools, dies, molds, and gages that require plating, need to be made aware of the importance of consulting with the plater. We hope you will be able to prevail upon some editors of publications directed to the metal working and tool industry to call attention to this subject.

May we have your permission to reproduce your editorial for distribution to a number of people we think may be interested? Or, if it is possible that your printer still has the plate standing, we would be happy to buy about one or two hundred reprints.

We want to congratulate you on your continuing efforts to better the standards of the plating industry and to call attention to their importance in industry.

Yours very truly,
H. O. Jacobson, V.P.
Nestor Johnson Mfg. Co.

Manufacturers' Literature

Rectifiers

Frederic B. Stevens, Inc., Dept. MF, 1800 18th St., Detroit 16, Mich.

A special electrical equipment bulletin supplement is now available, featuring three newly designed rectifiers and new voltage regulators for the metal finishing industry.

In all 55 different combinations of cabinet sizes, current and voltage output are available in the new series. Each is listed in one of several charts included in the supplement.

Rectifiers for Metal Finishing

American Rectifier Corp., Dept. MF, 95 Lafayette St., New York 13, N. Y.

Publication is announced of a new, 12-page catalog on the company's complete line of Selenifiers and controls for the electroplating and metal finishing industries. Replete with illustrations of bench type and floor models, it supplies technical data and ratings on every type available in these two general classes of rectifiers.

In addition, auxiliary equipment is listed, including remote control unit, timer device, automatic voltage and current regulators and stabilizers, periodic reverse controls, periodic reverse controls for generator field, automatic programming, shunts, meters and leads.

Polishing and Deburring

Hanson-Van Winkle-Munning Co., Dept. MF, Matawan, N. J.

A new four-page, two-color bulletin, MF-100, describes products and equipment used for mechanical metal finishing. Items covered in the bulletin can fulfill every requirement for operations in this field.

The bulletin lists the company's line of standard buffs, compositions, sisal buffs, brushes, polishing wheels, pol-

ishing & buffing lathes, and miscellaneous equipment & accessories. Featured in the bulletin are the Ruff-L-Buff, designed for fast cutting and cool operation; Acme greaseless compositions, used for either polishing, deburring or satin-finishing; and the Bias Sisalweev buff, which is made for heavy cutting down of either drawn, stamped or cast ferrous and non-ferrous surfaces.

Literature references are included for all products and equipment so a reader will know where to obtain complete details. The bulletin thus serves as a handy index on the firm's entire line of mechanical metal finishing products.

Finishing Bulletin

Frederic B. Stevens, Inc., Dept. MF, 1300 18th St., Detroit 16, Mich.

A completely new 16-page bulletin featuring the famous Stevens L.V.* (Laboratory-Verified) reports and how they can be used to aid metal finishing job shops or the metal finishing department in larger plants has just been released.

This new bulletin differs from previous catalogs in that it presents more than a list of polishing and buffing compositions regularly available. It features the L.V. report and explains how similar cost-cutting reports can be obtained for any plant metal finishing problem.

One section is devoted to a list of successfully solved metal finishing problems; How to test buffing compositions in the plant: Composition recommendations for plated and unplated surfaces; Automatic buffing requirements.

Copper, nickel, stainless steel and plastic buffing are also covered plus a section devoted to liquid compositions.

Of particular value to many metal finishing superintendents and foremen is a refference Index to treatment of materials at the back of the bulletin.

Rust Preventive Chart

Nox-Rust Chemical Corp., Dept. MF, 333 N. Michigan Ave., Chicago 1, Ill.

A new rust preventive chart, No. 954, lists those packaging and preservation materials which the company produces in conformance with various military specifications. Included are detailed properties of a number of products of interest to those firms doing industrial or military contract rustproofing operations.

Safety Clothing

Pulmosan Safety Equip. Corp., Dept. MF, 644 Pacific St., Brooklyn 17, N. Y.

The company's new and complete clothing booklet describing their full line of asbestos gloves and mittens, chrome leather clothing; including aprons, welding jackets, gloves and complete line of Pulmotek (vinyl) clothing now available upon request.

Koroseal Tank Linings

MW Protective Coatings Div., Metalweld, Inc., Dept. MF, Scotts Lane and Abbottsford Ave., Philadelphia 29, Pa.

A new four page bulletin which discusses, illustrates and gives considerable data on the application of flexible Koroseal sheet to plating tanks, racks, vats, etc. has just been made available.

Typical materials handled include nitric, sulfuric, and chromic acids, ammonium hydroxide, caustic, plating

THE ANSWER TO YOUR TANK HEATING PROBLEMS

FOR ACID HEATING JOBS

G SERIES
FUSED QUARTZ IMMERSION HEATERS

Over 40,000 CLEPCO Fused Quartz Heaters now in service.

Dependable, controlled heat at low operating cost.

Wide range of Standard Sizes for every need.

Only Fused Quartz Heater recommended and sold by all leading plating supply houses.

FOR ALKALINE HEATING JOBS

W & WS SERIES
STEEL AND STAINLESS IMMERSION HEATERS

Specify CLEPCO Non-Magnetic Stainless Steel Heaters for your alkaline electro cleaners and bright copper plating tanks.

Specify CLEPCO Steel Heaters for all other alkaline tanks.

All leading Plating Supply Houses can furnish from stock.

SEE YOUR PLATING SUPPLY HOUSE

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CLEVELAND PROCESS COMPANY
1965 EAST 57th STREET
CLEVELAND 3, OHIO

solutions, and many organics. Chief limitations are the chlorinated hydrocarbons and aromatics, gasoline and similar solvents and acetates.

How Cooling Towers Conserve Water

Aeme Industries, Inc., Dept. MF, Jackson, Mich.

The question, "How do cooling towers save you money?" is answered fully in a new catalog on Flow-Cold cooling towers. Gist of the answer is that cooling towers cool the water ordinarily discharged from refrigeration systems and allow it to be used over and over again—with over 95% less water consumption and important savings in water costs made possible. Where sewage rates are high, additional savings are gained.

Five models of Acme cooling towers are illustrated and described in the new catalog, with capacities ranging from 3 through 15 tons. Advantages of their heavy-duty, all-metal galvanized construction are detailed and complete dimensions are given to show their extremely compact size. A clear, simple selection procedure is given to enable the user to pick the model of tower best suited to his purposes.

Materials Handling Equipment

Economy Engineering Co., Dept. MF, 4511 W. Lake St., Chicago 24, Ill.

A new catalog features the new Worklifters, portable, battery-operated, hydraulic lifters, available in a variety of special purpose designs, in a 1,000 lb. capacity, and with lifts to as high as 80".

The catalog also describes Shoplifters—offered with both hand powered and electric hoisting units—and with accessories for die handling, or designed for handling drums.

Other products described include the elevating table, drum storage racks, drum trucks, shovel trucks, the Red Rocker barrel stands, the carboy tilter-truck and accessories for the Worklifters and Shoplifters.

Centrifugal Dryer

Nobles Eng. & Mfg. Co., Dept. MF, 645 E. 7th St., Saint Paul 6, Minn.

A new brochure describes with a cutaway photo the construction of the firm's air-drawn centrifugal dryer, equipped with steam and electric air heater in the cover. This eliminates space consuming and heat wasting separate units connected by pipe.

Thermostatic Temperature Regulators

Lawler Automatic Controls, Inc., Dept. MF, 453 N. MacQuesten Pkwy, Mt. Vernon, N. Y.

A 12-page catalog, Bulletin S-6, covering the Lawler Type "S" thermostatic temperature regulator, has just been issued. Claimed to be the most comprehensive engineering bulletin on the subject of thermostatic temperature regulators, the catalog explains where and when to use direct acting, reverse acting and three way type thermostatic temperature regulators and lists typical engineering specifications. It also explains where and how to use single and double seated valves. Profusely illustrated with cutaway photos and diagrams, installation diagrams and engineering tables, this bulletin gives complete information on the whys and hows of temperature

BEAM-KNODEL CO.

Metropolitan Distributors

HANSON-VAN WINKLE-MUNNING CO.

Complete Service for Metal Finishing

Products Listed Below Available in New York Stock With Reasonable Exceptions

GENERATORS

Anodes, All Kinds
Brushes
Buffs
Chemicals
Tripoli Comp.
Acme White Finish
Tallow
Rouge
Emery Paste
Cleaners
Emery
Glue
Nickel Salts
Copper Salts
Cyanide
Tanks, All Kinds
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195 LAFAYETTE ST., COR. BROOME
Phone CAnal 6-3956-7 NEW YORK 12, N. Y.

FILTERS

MAIZO Drying Materials
LEA Buffing & Polishing PRODUCTS

UDYLITE SERVICE DOESN'T COST—IT PAYS

These are cost cutting days—and it will pay you to investigate Udylite's free services to the plating industry.

DO YOU HAVE A DIFFICULT PART TO PLATE?

Take your problems to Udylite. We have a pilot plant where we will check your plating problem and make recommendations. It will save you from future costly mistakes. This service is free! Write to—

WORLD'S LARGEST PLATING SUPPLIER

THE Udylite CORPORATION
DETROIT 11, MICHIGAN

CORROSION-PROOF LININGS CEMENTS BRICK

- TANKS, FLOORS, FUME DUCTS AND PROCESS EQUIPMENT
- COMPLETE LINE OF PROTECTIVE COATINGS..

Over a Quarter Century of Experience

CEILCOTE CORROSION-PROOF MATERIALS • CONSTRUCTION • SUPERVISION

The CEILCOTE Co. 4844 RIDGE RD. CLEVELAND 9, OHIO

ranges, installation "musts," capacities and steam flows per hour. Special product features are gone into in great detail and cover overheat protection, lubricated stuffing box, trip valve with manual reset, a valve that "Fails Safe" and a long temperature range.

Industrial Apparel

Worklon, Inc., Dept. MF, 253 W. 28th St., New York 1, N. Y.

The above firm's latest catalog has a complete selection of work clothes made of Orlon and Dynel, fabrics which are resistant to acids, caustics and abrasion.

The catalog includes samples of the materials, items manufactured, advantages and prices of each. Copies are available on request.

Electroplating Processes

Hanson-Van Winkle-Munning Co., Dept. MF, Matawan, N. J.

A new four-page, two-color bulletin describes and lists key characteristics of 16 processes. These include seven nickel plating, three zinc, one cadmium, one copper with and without periodic reverse current, two silver, one lead and one bright ternary alloy plating process.

Included in the bulletin, P-100, is a list of 10 services available to H-VW-M customers. Readers may find out in this section what provisions the company has made for its customers to train platers, test processes & equipment, and advise on setting up & sequencing metal finishing operations.

Barrel Plating Equipment

George A. Stutz Mrg. Co., Dept. MF, 1649 Carroll Ave., Chicago 12, Ill.

The above company announces their new complete barrel plating equipment catalog for 1955. The line includes heavy duty production barrels, single and multiple plating units, cylinder leading and unloading stands, alkali cleaning and rinsing units, portable plating barrels featuring a new design. Power conversion equipment is also included.

Fiberglass Tanks

Laminex Corp., Dept. MF, 994 Jefferson St., Fall River, Mass.

The above firm has issued a bulletin on its laminex fabricated fiberglass tanks.

The construction of the tanks is touched upon, as is the economy in using glass fiber, and its advantages.

Measuring Instruments

Photovolt Corp., Dept. MF, 95 Madison Ave., New York 16, N. Y.

The company's new general catalog No. 100 contains their full line of photoelectric and electronic measuring instruments, including line and battery operated pH meters, and a number of recently developed items.

BUSINESS ITEMS

Korbelak Joins Sel-Rex Sales Organization

Alexander Korbelak, formerly editor of *Plating* magazine, official publication of the *American Electroplaters' Society*, has joined *Sel-Rex Precious Metals, Inc.* as sales manager, according to an announcement made by President, *Morris M. Messing*.

A graduate of Tufts College, Mr.

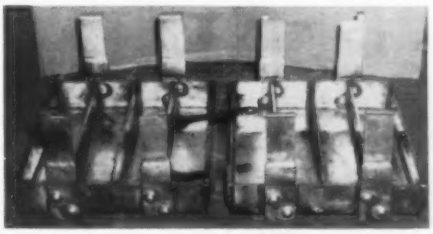
★ BUFFING NU SPRA GLU
Liquid buffing compound
since 1945

★ NUGLU
Cold flexible glue
since 1937

★ BRUSHING NUGLU
Grain and Nuglu mixture
since 1941

★ SPRAY BUFFING EQUIPMENT
Guns, pumps, and valves
since 1945

J. J. Siefen CO.
5643 LAUDERDALE · DETROIT 9, MICH.



Storts quality welding adds value to all your lead work

WHETHER the job is fabricating a pair of small solid lead tray anodes as illustrated, or installing a lead lining in a big tank, the Storts procedure for welding lead is the same. It never varies. Layer upon layer of weld offers a perfectly fused area of three to four times the base metal thickness, no porosities, no laminations, no undercutting. When Storts does it, your lead work is welded for full strength and maximum corrosion resistance.

STORTS WELDING COMPANY INCORPORATED
38 Stone Street
MERIDEN, CONN.
Manufacturers of Welded Fabrications to Specification

Alexander Korbelak

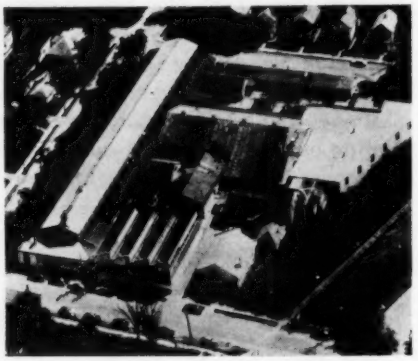
Korbelak is well known in the electroplating field. He has published a number of technical papers on techniques involved in electroplating difficult metals, and holds several patents on pulsating plating techniques and metal processing.

In addition to his association with the magazine, Mr. Korbelak spent 11 years in the electronics, chemical and metallurgical departments of Westinghouse Electric Corp. and worked as an electrochemist for Seymour Mfg. Co.

In his new position, Mr. Korbelak will direct sales activity and provide technical service for the complete line of precious metals plating salts and solutions and special plating chemicals produced by the company.

Stevens Adds to Plant at Springfield, Ohio

A new addition to the Springfield (Ohio) plant of *Frederic B. Stevens, Inc.*, metal finishing and foundry equipment manufacturers, was recently completed.



The new facilities have enabled the manufacturing operations to expand production of the firm's complete line of automatic rack and automatic barrel plating and metal processing equipment. The company's production of dryers and their new metal finishing waste disposal equipment will also be speeded up as a result of the expansion.

To better serve customers in the Ohio and Central States area, provision was also provided for special warehousing facilities enabling more rapid delivery of plating and metal finishing supplies in that area.

Washing Appointed New Wiretex Sales Engineer

C. J. Washing, residing at 851 Hancock Ave., Bridgeport, Conn., has been appointed sales engineer for the *Wiretex Manufacturing Co.*, in the territory covering Connecticut, Rhode Island, New Jersey, Delaware, and Maryland. He will handle the complete company line of baskets, retorts, muffles, grids, screens, racks, etc. for the plating and heat treating industry. Main office of

BRIGHTER

Barrel Nickel Plating with TRUE BRITE NICKEL BRIGHTENER

Increase Production

easy to control . . . cuts down on trouble that entails costly delays.

Save time

can be operated at a higher speed.

Reduce Rejects

gives unbelievable uniformity of deposit in recesses . . . brighter, white color.

Write for **FREE** *bulletin revealing tricks on improving your nickel plating and cutting costs.*

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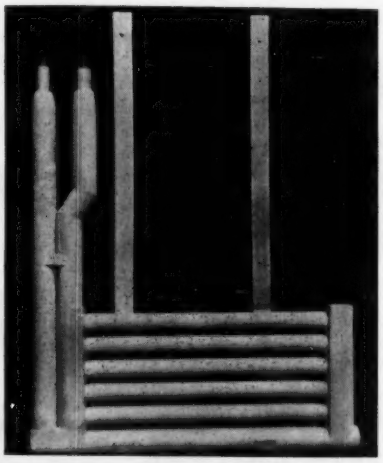
KNAPP MILLS, Inc.

Announces

THE KNAPP LEAD FLATCOIL



A newly designed compact heating or cooling unit. Provides the efficiency of the largest possible heating or cooling surface in the smallest possible tank area. Sturdy, easy to handle, and economical in cost. Manufactured in three different sizes for small or large requirements. For use with up to 15 lbs. steam pressure or 50 lbs. water pressure.

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C. J. Washing

the firm is at 40 Mason St., Fairfield, Conn.

Frederic B. Stevens of Canada Expands

Frederic B. Stevens of Canada, Ltd., has announced the completion of a new foundry and metal finishing supply warehouse in Windsor, Ontario, near their present plant and warehouse at 1262 McDougall.

The new building has increased loading dock facilities which will enable more rapid loading and delivery schedules for Canadian foundry and metal finishing plants. These loading entrances will also accomodate customer trucks taking advantage of the enlarged inventory stock.

In addition to the complete line of foundry facings, fire brick, plating chemicals and metal finishing supplies, the company is also stocking in the new warehouse the complete MacDermid metal cleaner and plating solution line, Roto-Finish processes and supplies, and American Colloid Volclay Bentonite and wood flour.

Hennessey Joins Wyandotte Chemicals

James H. Hennessey has joined the industrial sales and service staff of *Wyandotte Chemicals Corp.* He is a graduate of Germantown Academy, has been a resident of Philadelphia for six years and was recently general manager of a firm specializing in industrial storage tank cleaning.

Following intensive training at the company's industrial research and technical service laboratories, Mr. Hennessey will serve the metal working and metal finishing industries in the greater Philadelphia area.

James H. Hennessey

Amis Named Chief Draftsman at Stevens

Robert James Amis has been named chief draftsman of the *Frederic B. Stevens, Inc.*, Engineering department by *James Earton*, chief engineer. He fills the vacancy created by the promotion of *John Zytell* to engineer metal finishing waste disposal equipment and installation.

Before joining the firm one and a

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for setting up wheels, belts and rolls.

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Easy to make up in the first place!
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It's strong, too . . . and handles pickling acids with ease. Learn more about lightweight Monel equipment in free booklet, "5-Way Savings in Pickling."

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extra life
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INCO Monel Pickling Equipment

Robert James Amis

half years ago, Amis was with A. V. Roe and Co., Ltd., Malton, Ontario, in plant engineering where he helped make the plant layout for the automatic metal finishing section at Roe's new jet engine plant. He also worked on machine design and engineering with Canada's Dominion Rubber Co., Ltd.

During World War II Amis served as a wireless operator and navigator with the R.C.A.F. Coastal Command. In addition to in-service courses at the University of British Columbia, Amis also graduated with a major in machine design from the post war special Rehabilitation School in Windsor, Ontario, one of several special schools established to ease veteran over-crowding in Canadian Universities.

Amis is at present a member of the Detroit Branch, *American Electroplaters' Society*.

Wellen Named Bart-Messing Sales Engineer

Bart-Messing Corp., of Belleville, N. J. has named *S. D. Wellen* as a sales engineer, according to an announcement made by *Morris M. Messing*, president. Mr. Wellen will give industry technical assistance in developing diversified uses for Sel-Rex selenium rectifiers.

The new sales engineer is a graduate of Stevens Institute of Technology with a Mechanical Engineering degree, and has a M.S. degree in Electrical Engineering. Prior to joining the organization, he was manager of elec-

S. D. Wellen

trical engineering at Heyer Industries, Inc., in charge of rectifier equipment.

Du Pont Announces New Outlets for Vapor Degreasing Chemical

Greatly increased mid-continent availability of Triclene D trichloroethylene has been accomplished through the appointment of five new

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Industry's Abrasive
BONDING CEMENT
for Wheels and Belts

IMPROVES PRODUCTION PER WHEEL OR BELT
PROLONGS ABRASIVE LIFE

• We're not asking you to commit yourself blindly with a large order. We do suggest that you place a *trial* order for GRIPMASTER . . . a 75 pound pail or a package unit of 4 one gallon cans. Either will give you sufficient quantity to make a thorough competitive test. Then, if your production volume warrants, you can order GRIPMASTER in 660 pound drums.

When we ship your trial order, we'll let you know where our nearest distributor to you is located. Then you can deal directly with him and get his personal service on wheel and belt problems as well as other Lea products.

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We have recommended new equipment to many manufacturers that has paid for itself in a matter of months. Why not let us check your power set-up? Write to—

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STAINLESS STEEL and LINED TANKS
FOR EVERY PLATING OR PICKLING PURPOSE
CUSTOM-BUILT BY ONE OF THE LEADING FABRICATORS SOUTH OF THE MASON-DIXON LINE
ANY MATERIAL ANY LINING ANY SIZE
Electro-Polishing and Blackening
OUR PLATING AND POLISHING SHOPS HAVE OPEN TIME AVAILABLE FOR SPECIALTY WORK
RUSH YOUR REQUIREMENTS FOR PROMPT SERVICE
ROSAL METAL PRODUCTS MANUFACTURING CO., INC.
ELKRIDGE 27, MD. ELKRIDGE 409-513

distributors with six major outlets through the central belt of the nation, from Buffalo to New Orleans. This expanded distribution closely follows the introduction by Du Pont of a new all-purpose grade of the solvent.

The new distribution points are all operated by members of the Solvents and Chemicals Group of Chicago, a group of industrial suppliers associated to provide better service to manufacturers and other businesses requiring certain chemicals. Five other members of the same group, operating seven sales outlets in other sections of the central states, have previously become distributors.

The new distribution points for the Du Pont solvent and names of the firms operating these outlets:

Buffalo, N. Y.—Buffalo Solvents & Chemicals Corp.

Detroit, Mich., and Toledo, Ohio—Western Solvents & Chemicals Co.

Grand Rapids, Mich.—Wolverine Solvents & Chemicals Co.

Houston, Texas—Texas Solvents & Chemicals Co.

New Orleans, La.—Southern Solvents & Chemicals Corp.

Scancraft Plating, Ltd. Appoints V.P.

Herbert A. Skelton

The board of directors of *Scancraft Plating, Ltd.*, Metal Finishing Engineers, have announced the appointment of *Herbert A. Skelton*, Professional Engineer, as vice-president and general manager.

Mr. Skelton is a graduate of the University of Toronto, 1940, and is a past President of the *American Electroplaters' Society*, Toronto Branch. Prior to joining the firm, he was for many years chief metallurgist and chemist of the John Inglis Co. During the war Mr. Skelton served with the Royal Canadian Navy as Lieutenant (E).

Scancraft Plating, a newly incorporated Canadian company, are specialists in industrial finishing and treatments, precision electroforming, deposition of chromium and nickel for wear resistance and buildup. A complete service to engineers is provided for specification work.

DuPont Plans New Laboratory Building

Plans for construction of a $2,550,000 laboratory building in Wilmington, Del. for long-range and fundamental research by Du Pont's Electrochemicals and Pigments departments have been announced by the company. Facilities for each department will be provided in separate wings of the building, which is being shared for reasons of economy.

The latest laboratory project will provide about 50 scientists of the Pigments and Electrochemicals departments with additional space and the

A magnetic thickness tester ...

POCKET HANDI-GAGE

FOR ELECTRODEPOSITED, HOT DIPPED OR PAINTED COATINGS ON STEEL

Tests thicknesses from 0.0001 to 0.015 inch. Each individual gage is separately calibrated to National Bureau of Standards thickness plates, resulting in an accuracy to 10% for thicknesses over 0.0002 inch. As simple to use as an automobile tire gage, the Pocket Handi-Gage may be used on the production line or in the lab. It's perfect as a "Go, No-Go" thickness gage at the plating tank or spray booth.

NO BIGGER THAN A FOUNTAIN PEN, BUT WHAT A JOB IT DOES!

Tests brass, cadmium, copper, lead, nickel, silver, tin, zinc, lead-tin and zinc-tin alloys, hot dipped tin and zinc, paint, plastic laminations, enamel and lacquer on steel and other magnetic metals. Gives results in SECONDS. Especially adapted for hard-to-reach areas. Comes in a pocket-sized case complete with magnets for various thickness ranges.

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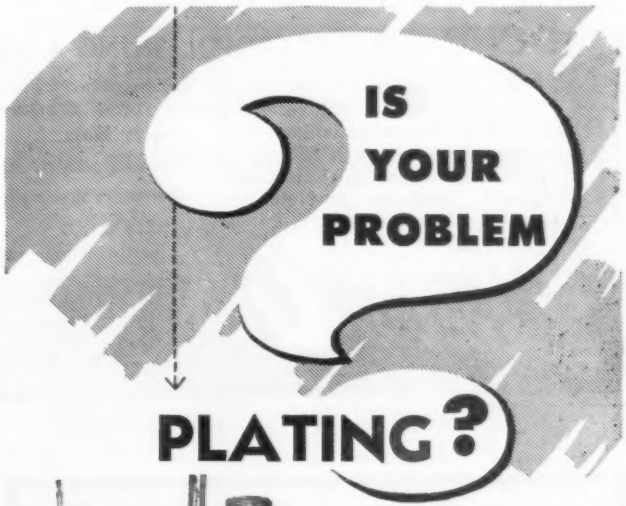

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Complete chromium plating unit. Tanks in all sizes.

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J. HOLLAND & SONS, INC.
475 Keap Street (corner Union Ave.) Brooklyn 11, N.Y.

newest in facilities for the kinds of research which, in the past, have led to the development of new products and new industries. Some research of this type now being conducted at the Electrochemicals Department plant at Niagara Falls, N. Y., will be transferred to the new laboratory, thus making available space needed for research at Niagara Falls.

The Pigments Department plans to transfer scientists from the crowded laboratory at Newport, Del., to join those now using temporary space at the Experimental Station. Substantial research, including titanium metal studies, will remain at Newport; new pigment color studies will be continued at Newark, N. J., where a new research laboratory is under construction.

The new two-story laboratory will be built to the east of present Experimental Station buildings. The building was designed and will be constructed by the Du Pont engineering department. *H. F. Redmile* will be field project manager. Site preparation will start immediately with the building scheduled for completion in 1955.

S. J. Stowell, Sales Manager Tranter Manufacturing, Inc.

Appointment of *S. J. Stowell* as sales manager for *Tranter Manufacturing, Inc.*, has been announced by *James R. Tranter*, president. Mr. Stowell succeeds *J. R. Tepfer*, vice-president who resigned July 31 as general sales manager of the Lansing, Mich. concern, manufacturers of Platecoil heat transfer units for industry.

S. J. Stowell

Mr. Stowell has been merchandise manager of the company since 1953 when he joined the organization after 14 months duty with the United States Navy as Operations Officer aboard a mine sweeper. Previously he was a district sales manager for the Lonergan Mfg. Co. and Refrigeration Corp. of America.

Ventilation Conference

The Fourth Annual Industrial Ventilation Conference will be held February 14-17 1955 at the Kellogg Center for Continuing Education, Michigan State College, East Lansing, Mich.

The course, co-sponsored by the Michigan Department of Health, Division of Occupational Health, and Michigan State College School of Engineering, is given for the purpose of bringing together plant engineers, ventilation engineers, ventilation contractors and other persons interested in good industrial ventilation.

The program will feature a combination of informal one-hour talks to the group as a whole on the subject of make-up air equipment and selection, as well as controls for this make-up air equipment. The talks will be followed by classroom workshop sessions on problems typical of the manufacturing industry, and a problem in mining ventilation. All members of the group will work from blueprints and drawings to design industrial ventilation systems.

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We maintain a customer laboratory for the testing of your solutions. Our free services will save you money. Why not find out for yourself. Write to—

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For PLATERS, SILVERSMITHS, JEWELRY MFGRS., makers of Watches, Clocks and Electronics and other metal finishers. Supplied in straight or crimped brass, steel, nickel silver or stainless steel wire in sizes .0025 - .006 and in bristle, fibre or Nylon. Special sizes and shapes to order.
Write (Dep't. M) on your letterhead for catalog and price list.

DIXON & RIPPEL, INC. KINGSTON, N. Y.

J. C. Harden Joins Wyandotte Chemicals

John C. Harden has joined the Industrial sales and service staff of *Wyandotte Chemicals Corp.* He will be located in Toronto to serve the metal industries in Ontario on the company's well known line of metal cleaners and related products and will report to the Montreal office.

Following four years with the Royal Canadian Corps of Signals, Mr. Harden studied chemical engineering at McMaster University. His metal finishing experience includes: 4 years on quality control in the electroplating department of Canadian Westinghouse Co. Ltd., 1 year as foreman of the electroplating and anodizing department of Coulter Copper and Brass Co. Ltd., and for the past year he has been foreman of the electroplating department of Houdaille-Hershey of Canada Ltd.

John C. Harden

Mr. Harden is a member of the *American Electroplaters' Society*. He has recently been given product application training at Wyandotte's industrial research laboratories, and has made a number of inspection trips to well known North American metal finishing plants.

Roto-Finish Expands Lab.

To further facilitate the development of special project machines, the *Roto-Finish Co.* has recently expanded their experimental laboratory facilities. The new laboratory will be devoted to the development and testing of abrasive media and machines designed for special purposes that is for finishing parts which ordinarily do not finish well or may not be adapted to finishing with conventional processes or equipment. The new types of equipment are par-

Insure successful, economical, uninterrupted

ZINC PLATING

by purifying cyanide zinc plating solutions with

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Zinc-Brite

TRADE MARK REG'D.

No Other Purification Treatment Required.

Simplifies Zinc Plating Procedure.

Substantially Reduces Overall Plating Costs.

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Sulphur Products Co. Inc.

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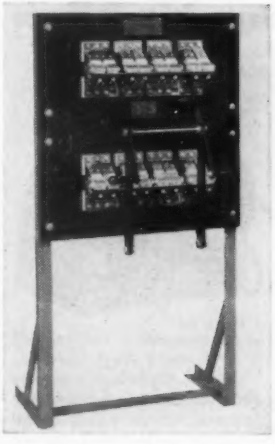
REVERSING SWITCH

Now Available in 3000 Ampere Size



For heavy duty service, the Columbia Double Pole, Double Throw, Reversing Switch with 3000 amperes capacity has been developed for use on direct current up to 15 volts. It consists of two 16" x 32" ebony asbestos panels mounted on angle iron supports 60" high. A manually operated handle, with effective leverage, permits the operator to easily open or close the switch mechanism. By placing the handle in a neutral position the line current is disconnected.

A total of sixteen heavy duty toggle-switches are mounted on the panels, four for each current direction. The cam action of the switch mechanism assures positive contact pressure. Contact surfaces are automatically cleaned by the inherent wiping action of the laminated copper moving contacts. Switch is rear connected, and is furnished complete with reversing jumpers and four terminals for outgoing and incoming bus bars. Stationary and movable contacts are readily replaceable.

While designed primarily to reverse the current flowing through a plating tank, the switch can also be supplied, when specified, for use as a series-parallel switch for double commutator generators.

Columbia Reversing Switches are also available in sizes of 300, 500, 1000 and 2000 amperes.

WRITE FOR DESCRIPTIVE BULLETIN MF-550

COLUMBIA ELECTRIC MFG. CO.

4529 HAMILTON AVE. CLEVELAND 14, OHIO

ticularly useful for processing parts which may be held in special fixtures and oscillated or driven through special grinding media, due either to the kind of material that the parts are made from or to the form or shape of the parts in question.

Lanno Joins M. M. Polishing

Generaso Lanno, former plant superintendent for one of the world's largest manufacturers of cigarette lighters for thirty-six years, has been appointed plant superintendent of *The M. M. Polishing Corp.* of 360 Fourteenth Ave., Newark 3, N. J.

Under the supervision of *Mary M. Windsor* who, for many years, has been active in the manufacture of fine surgical instruments, the corporation is devoted to the polishing and plating of aviation and electronic parts.

Sales Appointments by Raybestos-Manhattan

Raybestos-Manhattan, Inc., Manhattan Rubber Division, Passaic, N. J. has announced two appointments, effective September 1.

Frank A. McBrearity has been named Philadelphia branch manager of the Industrial Rubber Products Division succeeding *G. R. Van Duser*. Mr. McBrearity was Central New York sales representative and has served for 19 years in important sales capacities. He will make his new headquarters in the Suburban Station Building, Philadelphia.

Howard W. Smith succeeds Mr. McBrearity as sales representative for the Central New York area. Mr. Smith has served in various sales capacities in his 13 years with the company.

Solventol Chemical Products Adds to Staff

Solventol Chemical Products, Inc., Detroit, announces the appointment of *Dr. Henry A. Goldsmith* as chief chemist; and *Ben Ray* as manager of technical field service, Industrial Chemical Sales Division.

Dr. Goldsmith, as head of the research laboratory, will be responsible for product development and research. In addition, he will assist the technical sales and service division. Dr. Goldsmith was educated in Europe at the

Dr. Henry A. Goldsmith

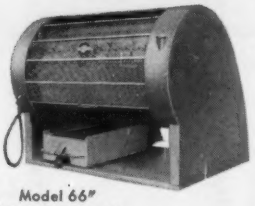
University of Berlin and the University of Genoa, Italy, where he received his degree. Before joining Solventol, he was associated with several Eastern firms, among them Colgate-Palmolive-Peet and Theobald Industries.

Mr. Ray brings to his new position several years experience with Solventol and prior to that with Chrysler, where he worked on the surface treatment

TUMBLE GRAV-I-FLO FINISH

...is the complete and authoritative source for all tumbling needs!

• **Machines.** 5 sizes—66″, 48″, 36″, 32″ and 24″. Cam locked doors with safety stop; unlined or rubber lined; constant or variable speed; J.I.C. controls; timers 5 min. to 20 hrs.; electric wiring and water piping.



Model 66″
Two compartments

• **Compounds.** Natural and synthetic deburring and finishing chips and highly developed compounds outperform every type of tumbling process offered.

• **Accessories.** Separator and chip grader, hoist pans, chip pans, wash-out doors, screens, chip bins, unloading boots, dip tanks.

• **Investigate.** Our representative will visit your plant, or you may send samples direct to us. Engineering Service available to all users.

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Ben Ray

of metals in the metallurgical and processing laboratories. He received his chemical engineering degree from Wayne University and is a member of the Detroit Chapter of *American Society for Metals.*

Arthur Liska Joins Nankervis

The *George L. Nankervis Co.*, engineers and manufacturers of electroplating facilities and industrial testing equipment, have announced the appointment of *Arthur F. Liska* as controller for the company.

Liska, a native Detroiter, enjoys a background of many years of experience in financial management. Prior to joining Nankervis, he was controller of the Burroughs Corp.

Eltex Chemical Corp. Takes Over Jetal Process

All rights to the Jetal process for blackening ferrous metals by oxidation have been acquired by the recently-formed *Eltex Chemical Corp.*, according to *Mark Weisberg*, president. Mr. Weisberg has retired as president of the *Alrose Chemical Co.* subsidiary of Geigy Chemical Corp., the post he held prior to the Alrose merger with Geigy. Eltex will manufacture and market Jetal and other chemical product.

The firm's address is P. O. Box 128, East Side Station, Providence 6, R. I.

Charleston Rubber Co. Expands

The *Charleston Rubber Co.* has just announced enlargement of its present physical plant, construction of new buildings, creation of an industrial products division and additions to its production and sales forces. The new division will specialize in development, manufacture and merchandising of a complete line of Charco rubber gloves and other items for furtherance of safety in industry.

Officers of the company are *Wm. J. Prohaska*, president, *R. M. Evans*, vice-president and sales manager, and *P. A. Belknap*, secretary-treasurer and technical director. The company headquarters and manufacturing plant are located in the Stark Industrial Park, six miles north of Charleston, S. C.

Cook Opens Detroit Office for Bart Manufacturing

L. David Cook, formerly head materials engineer at *Wyandotte Chemicals Corp.*, has been named sales engineer for *Bart Manufacturing Corp.*, according to an announcement made by *S. G. Bart*, president. He will open a Detroit office for the organization and also provide service for the associated companies, *Bart-Messing Corp.* and *Sel-Rex Precious Metals, Inc.*

Mr. Cook will be primarily concerned with development of markets

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★ Operate from —40° to 225° F.
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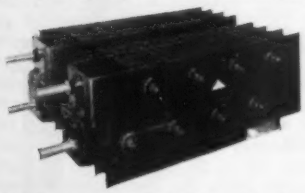
Two styles available—1. Selenium for cool zones, or 2. Magnesium copper sulphide for the hot, dirty jobs. Units still running after 4 years of constant duty.



Replacement Rectifier Stacks for Lektron or Udylite-Mallory

Magnesium copper sulphide rectifiers make your plating power supply more rugged and dependable. Magnesium radiator fins for fast heat dissipation and lighter weight. Matching pairs $265.00.

PRICE $750

Model 4045—750 amps at 12 volts DC—1500 amps. at 6 volts DC. Operates on 208, 220 or 440 A.C. Weight 525 lbs. F.O.B. Indianapolis, Indiana.

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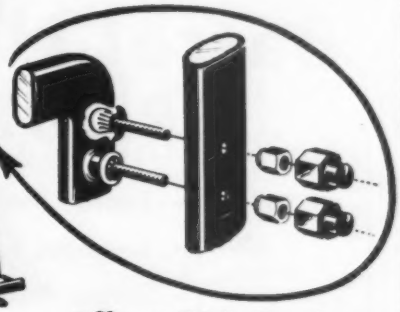
Plating Racks you can adjust to the job



Thinker Boy Racks are assembled from precoated members and tips. BELKE Vac-Seal Assembly seals the joints—only contact tips are exposed to the solution. Racks are easily disassembled without damage to coating.

Available as completely assembled racks or precoated rack members and tips.

Send for literature.

Effect BIG Saving

When Thinker Boy Racks for a certain job are no longer needed you can respace the members or disassemble and use the parts for other racks.

No added investment. Just order Thinker Boys when you buy racks. Instead of ceilings cluttered with no longer needed racks, you'll soon have a supply of Thinker Boy Parts — be able to assemble coated racks of your own design in a matter of minutes. Ask your BELKE Service Engineer or write for details.

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EVERYTHING FOR PLATING PLANTS

L. David Cook

in the mid-West for Bart Lectro-Clad nickel plated steel plates, seamless steel pipe and fittings which are used extensively for corrosion and contamination control in the chemical, pulp and paper and petroleum industries.

Broad experience in the corrosion control field includes work as a technical consultant on materials of construction for major chemical equipment used in production processes. Mr. Cook is a licensed professional engineer in the state of Illinois, and a member of the American Chemical Society, American Society of Metals and A.S.T.M. He was also one of the organizers of the Detroit section of the N.A.C.E. Mr. Cook's office in Detroit will be located at 18050 James Couzins Highway.

Home Study Course in Electroplating

Joseph B. Kushner Electroplating School, Dept. MF, 115 Broad St., Stroudsburg, Pa.

"Modern Hard Chromium Plating" is an advanced course for those who have completed "Electroplating Know How" or those who have the equivalent of a high school education and at least three years of plating experience or those who have a college degree and no experience. The course covers in detail every division of the subject: The properties of chrome plate. The basic facts of metallurgy as required for industrial chromium plating. The metallurgy of iron and steel. Hardness and Hardness testing. Stress and chrome plating. Stress relief methods. Surface preparation for hard chrome plating. Distribution of current in chrome plating baths. Racking methods and principles for uniform current distribution. Stopping off techniques. Dielectric properties of stop-offs. Production of porous chromium deposits. Finishing of plated surfaces. Control and operation of industrial chromium plating baths. Solution control methods and control of impurities. Calculations for specification deposits. Chromium plating wastes and their treatment. A Certificate is awarded to successful students.

Stevens of Canada Purchases Roto Finish of Canada

Frederic B. Stevens of Canada, Ltd., has purchased the *Roto-Finish Company of Canada, Ltd.*, including manufacturing rights and complete inventory.

The Roto-Finish complete line of metal finishing tumbling equipment, processes and supplies will be stocked in the Stevens Toronto warehouse and the recently enlarged Windsor warehouse for rapid delivery to all parts of Canada.

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Barrel Nickel
BRIGHTENER

can be used with present Barrel Nickel plating solutions

- Faster Plating
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- Single Addition Agent
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- Many *plus* Advantages

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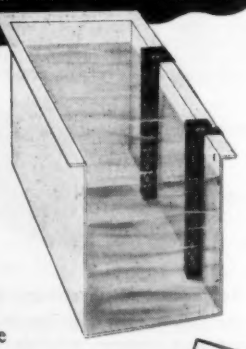
ELECTRIC RADIANT IMMERSION HEATERS

Heat by far Infra-Red. The scientific application of heat to all plating, pickling and phosphatizing solutions.



Features:

- Underwriter's Lab. approved junction box
- Midget fuses inside junction box
- Guard, holder, and junction box have Plasti Sol-type coating
- Renewable heating elements
- Use with automatic temperature controls

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Mfgrs. of Fused Quartz Electrical Heating Elements
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News from California

By Fred A. Herr

The Hallmack Co. of Los Angeles has completed a 70 x 80 foot two-story general office building at Washington Blvd. and Magnolia Ave., adjacent to its main plant. Floor space formerly occupied by administrative departments has been added to the assembly and warehouse sections. *Don Bedwell*, factory superintendent, reports that the plant's power input has been increased from 2,000 to 4,000 amperes as a preliminary step in realigning the plating division for more streamlined operations.

A night school course in the fundamentals of electroplating and plating chemicals began September 14 under the sponsorship of the Extension Division, University of California. Classes are to be held one night a week from 7 to 9:30 o'clock for 18 weeks at 813 South Hill St., Los Angeles. *Mitchel Raskin*, plating foreman of the Ajax Hardware Mfg. Co., serves as instructor for the ninth consecutive year.

During the years Raskin has taught the class he estimates that 300 or more men have attended, either to learn the fundamentals of plating from the beginning or to brush up on new techniques to supplement their present knowledge. Enrollment, Raskin reported, varies from individuals to entire personnel of shops with fees paid by the owner. He recalled occasions when Lockheed Aircraft Corp. of Burbank, Cal., underwrote the course for as many as fifteen of its staff at the same time.

Pennsylvania Salt Mfg. Co. reports the appointment of *Burton G. Adams* as sales representative in Southern California for its Chemical Specialties Division. Adams will represent the firm's full line of Pennsalt cleaning and metal surface preparations, including the Fosbond and Foscoat processes. It was announced that Adams will be available for service to metal finishers throughout the Southern California district. His headquarters are at 4820 Loma Visa Ave., Los Angeles.

Jerome E. Spratt, formerly foreman of the finishing department of Mission Appliance Co., Hawthorne, Cal., has been appointed to the sales force of Oakite Products, Inc., producers of industrial cleaners and metal treating materials. Spratt will devote his efforts to servicing the metal finishing industry in East Los Angeles, Glendale, Alhambra and South Pasadena. He recently completed an eight week indoctrination course at Oakite's New York headquarters.

Merit Products, Inc., of Culver City, Cal., manufacturers of Grind-O-Flex flexible grinding wheels and Sand-O-Flex countour sanders for the metal finishing industries, reports the appointment of three new sales representatives in the east and middle-west.

According to *Ray Hermanson*, sales manager, the following firms will handle the line: New York State: W. J. Holtmeier Co., 71 West 23rd St., New

FILTER 50-1500 GAL/HR ANY ELECTROPLATING SOLUTION

NO ROUGH DEPOSITS
NO PITTING

Self-Priming MODEL LSIN-10 Cap. 100 gal/hr H. T. Lucite Filter Assembly

SERVICE: Filters practically any acid or alkaline solution from pH 0 to pH 14; removes particles down to one micron in size. Strainer stops metallic objects.

DESIGN: Filter Assembly fabricated of stainless steel 316, high temperature lucite, rubberlined. Haveg, or Sethrin* resin. **Filter Tubes** of cotton, dynel, porous stone, or porous carbon. **Pumps** fabricated of Hastelloy, stainless 316, or plastic; centrifugal or self-priming. **Motors** drip-proof, totally enclosed, or explosion-proof, 110 or 220 volt, single or three-phase, 50 or 60 cycle, sleeve or ball bearing. **Hose**—special, acid and alkali resistant. **Base**—phenolic laminate on rubber tire ball bearing casters.

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Stainless Pump Totally Enclosed Motor Portable—Wt. 60 lbs. 14" x 16" x 16" high

Distributors in Principal Cities

Model	Rated Capacity	Overall Size	Weight
LSI-5	50 gal/hr	11" x 14" x 12"	30 lb.
LSI-10	100 "	12" x 16" x 16"	40 "
ASI-300	300 "	2' x 2' x 2'	125 "
ASI-400	400 "	2' x 2' x 2'	135 "
ASI-600	600 "	2' x 2' x 2'	150 "

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York, Herren-Sims Co., 1601 St. Clair Ave., Cleveland, O., in West Virginia and Ohio; and Norman Dahley, 329 S. Wood St., Chicago, in Illinois and Wisconsin.

Other recent appointments in various fields of the chemical and finishing fields in California include the following:

Russell T. Drennan as general sales manager for the Chemicals Division of Kaiser Aluminum & Chemical Corp., with headquarters in Oakland, Cal.

Robert B. Grant as Los Angeles Branch manager for Minneapolis Honeywell Regulator Co.

Ray T. Hanson as western manager of the Borden Co.'s Chemical Division, succeeding *William R. Moffett*, now vice-president and technical director in New York City.

Victor P. Roy as plant superintendent for Universal Metal Products, Inc., Alhambra, Cal.

Jules F. Board, Jr., as Pacific coast manager of sales and technical service for Titanium Metals Corp. of America, with offices at 5333 East Slauson Ave., Los Angeles.

Dr. Arnold O. Beckman, president of Beckman Instruments, Inc. and the Helipot Corp., South Pasadena, Cal. was recently elected to the board of directors of the California State Chamber of Commerce. He is also a trustee of the California Institute of Technology, Pasadena, Cal.

Everlube Corporation, North Hollywood, Cal., announces the establishment of customer processing plants at Russell Products Co., Inc., 3116 West 32nd St., Cleveland, O., and Filmcote, Inc., 2140 S. Kilbourne Ave., Chicago, Ills. The firm produces Everlube dry film lubricants.

Chase Brass & Copper Co. recently held open house to give the metal finishing and fabrication industries of Southern California an opportunity to view their new office and warehouse building at 6500 East Washington Blvd., Los Angeles.

A buffet lunch was served to some 1,600 guests after which executives and staff members of the firm escorted the visitors on a tour of the plant. Present were *R. C. Diehl*, president, *R. A. Sternthall*, Los Angeles district manager; *C. W. Baker*, western regional manager; and *J. K. Ross*, Los Angeles office manager.

The new facilities are housed in a 50,000 square foot building on a 4½ acre site representing a million dollar investment.

Construction is now underway on a 21,000 square foot regional headquarters building for the Minneapolis-Honeywell Regulator Co. at 6620 Telegraph Road, East Los Angeles, Cal.

Construction was started in September for a new factory building for B. & T. Metals Co. of Columbus, O., in the Vail field section of the Los Angeles Central Manufacturing District. Land, building and equipment will represent an investment in excess of $1,000,000. The firm fabricates and processes extruded aluminum shapes and metal edgings. It will launch its first full-scale West Coast operations upon completion of the building. Initial operations will begin in a building of 40,000 square feet floor area, with future expansion planned for an additional 15,000 square feet.

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. . . the name of our new composite abrasive for hard buffing compounds used on non-ferrous metals . . . in laboratory tests and actual use TAMART has proven equal or superior to similar abrasives now in use . . . and of special interest to you, TAMART is far more economical.
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OUR FIELD SERVICE STAFF IS LARGE
In fact, largest in the electroplating field. That means you get frequent service check-ups. We maintain Udylite equipment at top performance. It's all free, of course. Just another plus when you buy from Udylite.
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PLATING
In the Modern Way
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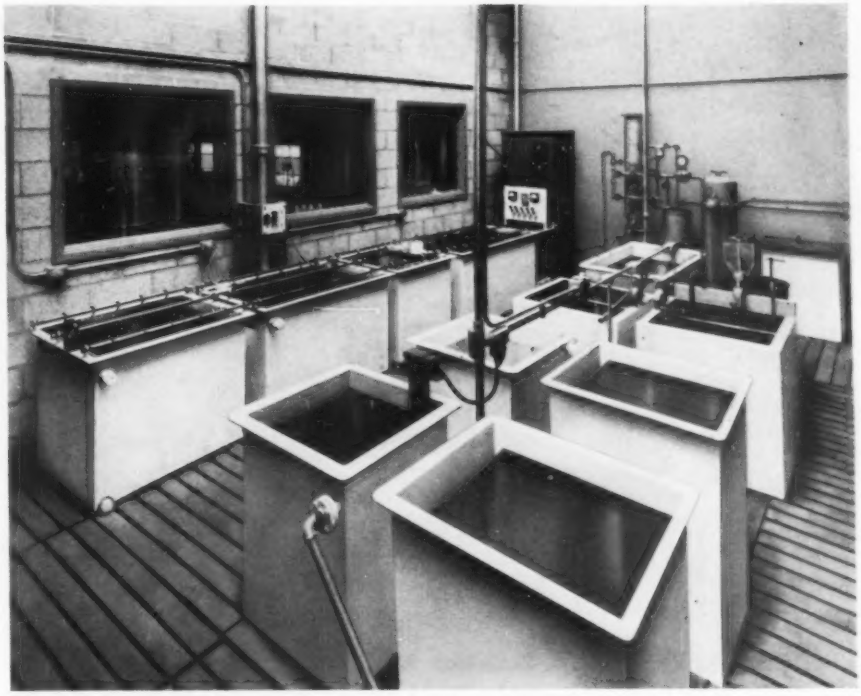
New West Coast Facilities

65 Year Old Supplier Expands

The recent completion of a $250,000 plant addition by the *L. H. Butcher Co.* of Los Angeles, Cal., to round out its manufacturing, distribution and research facilities, focuses attention not only on the impressive growth of this supplier of metal finishing products and industrial chemicals, but also emphasizes the tremendous expansion the plating industry has experienced on the West Coast during the six decades the firm has been in business.

Since its modest beginning in 1890 as a paint and varnish supply house in San Francisco, the company (since 1952 a *Udylite* subsidiary) has grown into one of the largest manufacturers and distributors in its field on the West Coast. With main offices and plant in Los Angeles, it operates branches in San Francisco, Seattle, Spokane, Portland, and Salt Lake City.

Through its metal finishing division, the L. H. Butcher Company serves as a manufacturer and distributor of plating, polishing, and organic finishing supplies and equipment.



Metal finishing pilot plant is a complete plating plant equipped with tanks ranging in size from 60 to 100 gals. View through windows (left) shows the plating laboratory.

To provide larger production areas for the manufacture of brighteners, cleaners and polishing compounds, as well as to equip itself with modern research and laboratory facilities, the company in 1953 launched construc-

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. . . with Boltaron 6200, a versatile, lightweight structural material that virtually wipes out maintenance and replacement costs. Already in use in hundreds of operations, Boltaron is corrosion-resistant throughout, remains unaffected indefinitely by both strong and weak organic and inorganic acids, alcohol, alkalies and foodstuffs. Available in sheet, rod, pipe and block stock. Highly adaptable to complicated shapes and readily drawn, formed, molded, machined and hot air welded. Trained representatives and fabricators located near you will work with you. Write Box 823, H. N. Hartwell & Son, Inc., Park Square Building, Boston, Mass., for more information.

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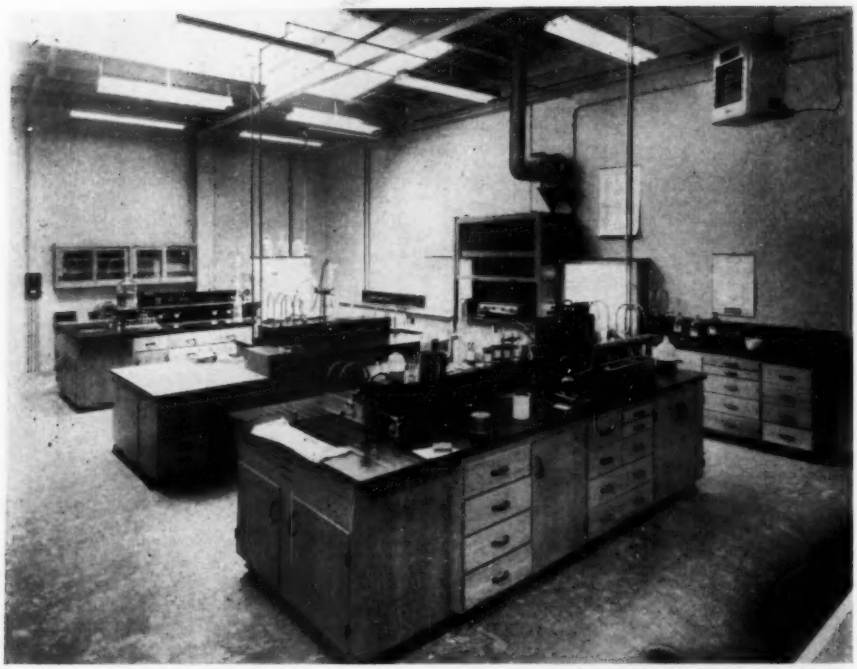


New $50,000 Metal Finishing Laboratory is divided into two sections. One for analysis of plating solutions; the other to manufacturing control of metal finishing items produced by the company.

tion on a quarter million dollar addition to its Los Angeles plant at 3628 East Olympic Blvd.

The addition consists of a 20,000 square foot concrete building at the rear-eastern portion of the existing plant. It includes electrical manufacturing, mixing, buffing and polishing compound production units, a metal finishing laboratory and a pilot plant.

The new manufacturing unit is one story concrete tilt up with a steel truss and wood roof with large skylights. Gas, water, and compressed air are available through the center of the entire building including all the units from taps installed every twenty feet. Fireproof sliding doors are located conveniently throughout to enable easy material handling from either alleyway or street. The north third of the building is two stories high and houses the buffing, polishing and mixing equipment. Liberal storage space is available on the second floor, making for convenient movement of raw materials into the hoppers of the machines in the polishing and mixing department on the lower floor. One of the rooms in this unit is completely explosion proof for the mixing of dangerous chemicals.

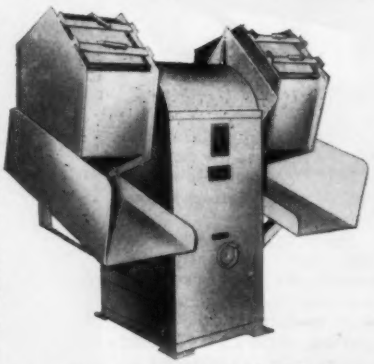
New $50,000 Laboratory

The company's new metal finishing laboratory, built and equipped at a cost of $50,000, is reported to be the largest and most modern of its kind in the West. It is divided into

NEW! RAMPE TWIN
PRECISION BARREL FINISHER

Super Twin With Double Capacity

Provides larger volume capacity—4 cu. ft. (2 cu. ft. per barrel). Sturdily built and powered by a ¾ H.P. 220/440 volt, 3-phase motor — Variable speed drive — Barrels can be vinyl plastic lined, if desired. Movable chutes act as safeguards when tilted to the rear. Tote boxes can be furnished in place of movable chutes.



Prices from $735.00 to $995.00 depending upon equipment.

OTHER RAMPE BARREL FINISHERS

Three other Rampe Barrel Finishers are available—2 single units and 1 Twin model. They range in price from $99.50 to $685.00, depending upon size and equipment.

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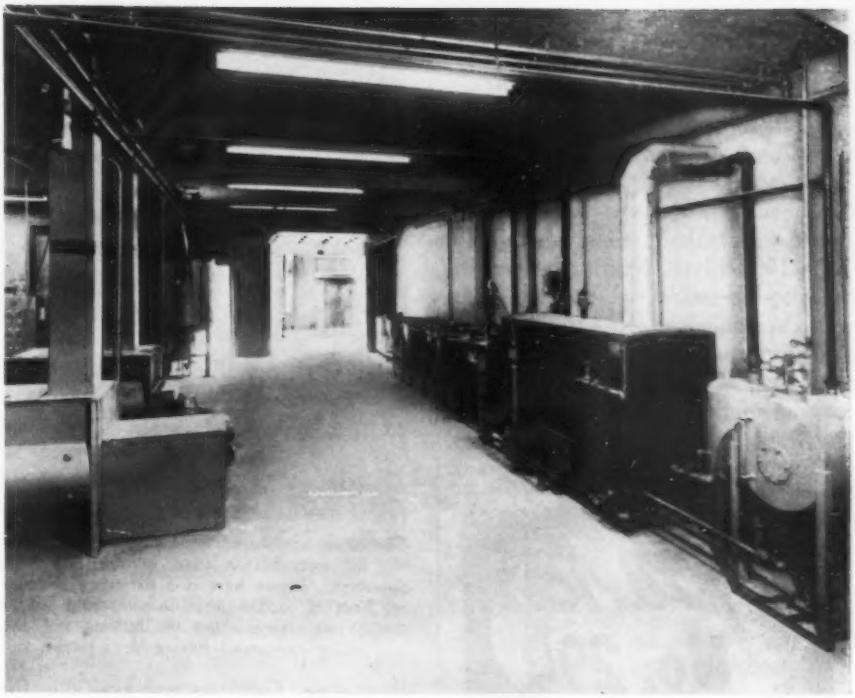
separate sections, two of which are devoted entirely to the analysis of plating solutions. Equipment is available for volumetric, gravimetric, colorimetric and crystallographic analysis, as each particular solution may require. The laboratory is also equipped to run plating cell tests in which panels are plated in the customer's own solution under carefully controlled condition. The results are then compared with standards and past records of performance on the same solution. These two sections are also equipped to handle the analysis of special solutions used in pickling, phosphating, blackening and cleaning.

Another area of the laboratory is devoted entirely to manufacturing control of metal finishing items produced on the West Coast by the company. All raw materials are checked for conformance to specifications, but samples of all finished products are tested, as well, prior to their release for sale. In this section, the control and testing work is also done for the various nationally known specialty processes which are manufactured and sold on the West Coast under licensed agreements.



View of the new department in which buffing and polishing compounds are manufactured, showing some of the modern mixing vats and compounding machines. The raw materials for this unit are stored on the upper floor of the building.

Another section of the laboratory is devoted entirely to the formulation testing and custom tailoring of polishing and buffing compounds. This department is equipped for manufacturing control and raw material inspection. The equipment includes viscosi-

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When you buy from Udylite you get "More Than A Pound." Udylite gives you these 6 important helps beyond outstanding equipment and tested supplies at no extra cost.

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- The new Udylite Research Corporation continually working to develop a new and better way of plating.

Call us in on any plating problem. Get these Udylite "More Than A Pound" services without cost or obligation.

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WORLD'S LARGEST PLATING SUPPLIER

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THER SELENIUM RECTIFIER

Best suited to your particular application.

Ther 12 v., 5000 amp. Self-Contained Rectifier.

Feature by feature, Ther Plating Rectifiers are job-rated to give you the most in DC power for your operation.

Conservatively rated premium quality selenium stacks deliver D.C. at peak efficiency to cut production time to a minimum and save on power costs.

Arc-eliminating voltage controls protect and lengthen service life of components and equipment.

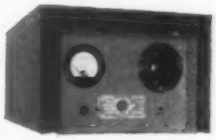
Copper conductors and bus bars are used throughout to provide maximum conductance and resistance to corrosion.

Fully enclosed ball-bearing fan motors are incorporated in all units.

Vacuum cooling, proven in practice as the most effective means of producing uniform air distribution.

Models are available as either 5% or 18% ripple depending on which is most suited to your operation.

RESULT: HIGH EFFICIENCY, LONG LIFE AND TROUBLE-FREE OPERATION.



Ther also manufactures Bench Model Rectifiers. All models are drip-proof in construction, convection cooled and complete with stepless variable voltage control. Sizes range from 25 to 250 amps. 6 v., 150 amp. unit shown.

Ther Rectifiers for plating or anodizing are available in a complete line in sizes ranging from 6 to 50 v. at from 25 to 30,000 amps, with self-contained or remote controls; either manual or automatic.

Contact Ther for your specific needs in plating power. Request new Bulletin 5500, containing important data on rectifier arrangements and valuable installation hints.

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meters, microscopes, melting point apparatus and reflux stills.

Metal Finishing Pilot Plant

The company's new Metal Finishing Pilot Plant occupies a separate glassed-in room adjacent to the laboratory. A complete plating plant has been installed with tanks ranging in size from 60 to 100 gallons. Nearly every metal finishing operation can be carried out with the equipment on hand, whether it is experimental or for plating or processing of customer samples.

Some of the plating solutions used are bright nickel, bright cadmium, bright zinc, high speed copper, and chromium. Facilities are available for emulsion cleaning, electrolytic cleaning, and soak cleaning. Provisions have been made for pickling, bright dipping, and conversion coatings. A high velocity abrasive blast unit has also been installed in this area. Demineralized water equivalent to triple distilled water is produced, both for the laboratory and pilot plant, by a mono-bed, "Water Conditioning" demineralizer.

Jack Raskin is the West Coast manager of the metal finishing division, with direction over the firm's metal finishing operations in the eleven western states. *Earl W. Arnold* serves as assistant manager as well as director of laboratory and research operations.

The latest equipment for expediting the handling of materials is used in the company's operations. Shown here is a lift-truck depositing bags of sodium bisulfite anhydrous in the storage warehouse above the buffing and polishing compound mixing department.

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Black Oxide finishing for rust resistance and decorative parts. Speedy black coating in water solution with no electric current. Permanent black finish on ordnance parts, tools, aircraft, bearing races. Dazzling black decorative finish for television cameras, business machines, hardware, metal screens and machine parts. Excellent bond for paints and enamels. Simple one bath operation. Write for bulletin H-16. Park Chemical Co. 8075 Military Ave., Detroit 4, Mich.

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NEW BOOKS

Quality Control

By Norbert L. Enrick. Published by The Industrial Press, 148 Lafayette St., New York 13, N. Y. Second Edition 1954. Price $4.00. 181 pages.

Some 60 pages of new text, tables and charts have been added to the new edition to provide a more complete coverage of the various aspects of the subject. This book offers a simple, direct approach, emphasis is placed on the practical applications of quality control, and the fundamentals are explained at the level of a reader unfamiliar with the subject. Placing of the mathematical theory in a separate chapter, which we naturally avoided, tends to instill confidence in those who are interested in an introductory text. With this obstacle safely hidden away, the practical man will find the book quite valuable in enabling him to keep up with one of the more recent innovations in the field of metal finishing—improvement of quality and scrap reduction by statistical quality control.

Metal Industry Handbook & Directory

Published by Metal Industry, Dorset House, Stamford St., London, S.E.1, England. 1954. Price 21s. 8d. Paper cover. 472 pages.

The 43rd yearly edition of this well-known, comprehensive reference book for workers in the non-ferrous metal industries brings up to date the wealth of information accumulated over the years. The handbook is available with the weekly journal *Metal Industry* at a combined subscription price of £3.5s. 0d; has an extensive Buyers' Directory which would be of little interest to American readers; and up-to-date material on the properties of the newer, as well as the more familiar metals, which would be quite valuable to metal workers. The section on metal finishing covers only about 10 per cent of the volume but, as a result of judicious condensation, is still fairly complete.

Industrial Inorganic Analysis

By Roland S. Young. Published by Chapman & Hall Ltd., 37 Essex St., W.C.2, London. 1953. Price 36s. 368 pages including index. (Orders will be filled by John Wiley & Sons, 440 Fourth Ave., New York 16, N. Y.)

This volume, written primarily for the industrial analytical chemist, presents the results of the author's many years of experience. In addition to detailing the procedures for determining all the commonly employed metals, comments and suggestions are included, which are even more valuable to the technician since most books on analysis present a number of different methods and leave it to the analyst to select the most suitable one. Various hints given on manipulative technique will be most helpful to younger, inexperienced workers.

Associations and Societies

AMERICAN ELECTROPLATERS' SOCIETY

LOS ANGELES

Elburn C. Marcum, West Coast technical representative of the Du Pont Company, El Monte, Cal., addressed the first Fall meeting of Los Angeles Branch of the *American Electroplaters' Society* at Rodger Young Cafe, September 8th on "Some Important Elements in Cyanide Plating."

Mr. Marcum's presentation was, in the main, extemporaneous, with much of the period alloted to him devoted to discussion of blackboard formulas with which he showed the causes responsible for various effects noted in cyanide baths.

He discussed the various factors involved in cyanide solutions, such as formulation of the solution, additives and operating conditions, all of which, or any one, he pointed out, may be the cause of some undesirable effect. The mistake made too often by platers, he declared, is that they look too closely at the effect and pay too little attention to what produced the effect. He also deplored the tendency to jump to conclusions based on past experience.

The opening Fall meeting was attended by 80 members and guests. The guests included *Sol Goldman* of Ace Metal Finishers, and *Ted Goodman* and *Edward Zoran* of Chemplate Co.

L. Truman Stoner reported that a committee recently assigned to that task had completed the initial draft of a set of by-laws for the branch which, he reported, will be presented to the general membership for discussion and approval at the November 10th meeting.

The secretary's report revealed that the membership drive now in progress, and which will continue till March, 1954, has advanced branch membership to 251, largest total on record.

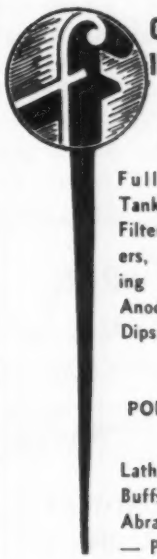
Jack Bealle, a delegate to the Supreme Society convention in New York, reported he felt confident that the misconceptions, which Eastern and Mid-Western members held concerning the reasons why Los Angeles branch cancelled a national convention assigned to it several years ago, had been satisfactorily cleared away. Bealle reported that Los Angeles' bid for the 1960 conclave is on file and that the chances for approval are favorable.

Pittsburgh Branch

The Pittsburgh Branch held its first regular meeting of the fall on Wednesday evening September 1, 1954. As is customary the meeting was preceded by dinner. One new member was welcomed into the Branch, *Alexander Hays, III*, and two guests from National Electric Co. were present.

Before the meeting got underway, *R. Goldbach*, in behalf of the Branch, presented a beautiful pipe and a can of tobacco to Mr. Ryan of the Sheraton Hotel in appreciation of all he has done for the members in providing our meeting room and arranging the dinners.

The speaker for the evening was *Arthur H. DuRose*, Manager of Electroplating Development for the *Harshaw Chemical Co.* His subject was "Electroplating—Art or Science." The



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main point of Mr. DuRose's talk was the poor reproducibility in electroplating work due to the individual artistic touch involved in doing the work. Librarian, *Fred Dixon*, presided over a very lively discussion period on nickel plating and salt spray testing.

As an added attraction this year, a door prize is being given away at each meeting this year courtesy of the suppliers. *Bill Musmanno* was the lucky member by winning a Universal Automatic Coffee maker presented by Harshaw.

Announcement was made of the special program set up for the October meeting. President *R. Varner* has arranged for a tour of the Weirton Steel Co's Tin Mill. Weirton has one of the largest and most modern tin mills in the country where strip steel is electroplated on a huge scale at great speeds. The customary dinner that precedes the meetings will be courtesy of Weirton Steel. At the meeting, after dinner. *John A. Swift,* President of Swift Industrial Chemical Co. will present his talk "Manufacture, Rolling, Cold Working of Steel and How These Factors May Affect Plating." The day, October 6, 1954, the time 2:30 P.M., and the meeting point is the Weirton Community Center.

After enjoying refreshments the meeting adjourned.

Herb Schram,
Secretary

OBITUARIES

F. LLOYD WOODSIDE

F. Lloyd Woodside. 58, president of *Park Chemical Co.*, 8074 Military, Detroit, Mich., died August 9. He had been president of the company since 1942, and before that time was associated with the following companies: Studebaker Corp. 1911-1924, Craine Schrage Steel Co. 1924-1929, Ludlum Steel Co. 1929-1935 and Climax Molybdenum Co. 1935-1942. He was a brother of W. P. Woodside, chairman of the board of Park Chemical Co.

MATHEW IDING

Mathew P. Iding. president of the *M. P. Iding Disc Grinding Compound Co.*, died recently of a heart attack.

Mr. Iding had worked for the International Harvester Company for 30 years before retiring in 1936 and starting his own firm.

He is survived by his wife, a son, two daughters and a sister.

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